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ABSTRACT

Designed to aid States in planning and developing two-year post-high school programs in veterinary science technology, the curriculum guide presents a suggested curriculum for a training program in veterinary science technology, with an option in meat inspection and regulatory technology effective in the fourth semester of the training period. Part 1, Veterinary Science Technology Program, provides general information on the emergence and development of this career, occupational opportunities, type of education needed, and activities performed by technicians, as well as various aspects of the training program. Part 2, Curriculum, outlines the four-semester curriculum and provides brief course descriptions. Adaptations for a cooperative education plan and continuing study are described. Approximately half of the document consists of Part 3, Course Outlines, which offers content, procedures, and resources for the technical specialty courses, auxiliary and supporting technical courses, mathematics and science courses, and general courses. The concluding section covers general planning, land requirements, laboratory facilities and equipment, acquisition of equipment and estimated costs, and a cost summary. A bibliography and a selected list of scientific, trade, and technical societies concerned with veterinary science technology are also included. (EA)

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VETERINARY SCIENCE TECHNOLOGY

A SUGGESTED TWO-YEAR POST HIGH SCHOOL CURRICULUM

CE 004 817

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FOREWORD

DURING the decade of the "sixties" this nation witnessed the emergence of many new career specialties. However, probably none of these new technical career fields has developed as rapidly and dynamically as the one in *Veterinary Science Technology*.

A key factor influencing the rapid development of careers in veterinary science technology has been the continually accelerating and expressed need for paraprofessional personnel to support and complement the efforts of veterinary practitioners, public health and regulatory officers, and biomedical research scientists. Ironically, while this need has existed for some time, education in this field has been limited largely to four year degree, graduate, and professional levels. Some on-the-job training and structured in-service training programs have been developed, but there still remains a large educational void between the professional employer and the unskilled laborer in this vocational field.

During the late 1960's and early 1970's, Federal legislation favoring and encouraging the development of two-year educational programs in technical and occupational areas provided funds and other assistance to help close these educational gaps wherever they existed. Moreover, adequate manpower is available and anxious for training in this occupational area. In fact, there is presently a veritable explosion of interest occurring across the nation as evidenced by the numbers of students making application to established veterinary science technology training programs. Likewise, educational administrators throughout the country are considering the feasibility of establishing this type of training program at their institutions. In recognition of this mounting interest and in answer to increasing numbers of requests for information describing this new technology, the U.S. Office of Education developed this suggested curriculum guide.

The guide which follows, is intended to aid the states in planning and developing two-year post high school programs in veterinary science technology, or in evaluating existing programs. Although the indicated level of instruction is post-high school, the sequence of course work may well start at any grade level where students have the prerequisite background and understanding.

This guide presents a suggested curriculum for a training program in Veterinary Science Technology, with an option in Meat Inspection and Regulatory Technology which becomes effective in the fourth semester of the training period. The guide also includes suggested course outlines with accompanying examples of texts, references, and instructional media; a sequence of technical education procedures; laboratory layouts with equipment and costs; a discussion of the library and its use, faculty and student services, and land requirement; and a selected list of scientific, trade, and technical societies concerned with this technology.

This project was funded by the Division of Vocational and Technical Education, Bureau of Adult, Vocational, and Technical Education, U.S. Office of Education. It was conducted under the supervision and direction of Walter J. Brooking and H. Neville Hunsicker, program specialists in the Division of Vocational and Technical Education, and William Berndt, project officer, Curriculum Development Branch, Division of Research and Demonstration, all of the Office of Education. The basic materials were prepared by Walter E. Collins, D.V.M., project director, State University of New York Agricultural and Technical College at Delhi, pursuant to a contract with the U.S. Office of Education.

Many useful suggestions were received from special consultants and advisors, proprietors of veterinary hospitals and other employers in the veterinary-biomedical fields, and administrators and teachers in schools of technology. Although all suggestions could not be incorporated, each was carefully considered in light of the publication's intended use. In view of this, it should not be inferred that the suggested curriculum with its related option is completely endorsed by any one institution, agency, or person. The guide presents a plan for a suggested training program, a plan which may be modified by administrators and their advisors to conform to local, state, and regional needs.

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THE VETERINARY SCIENCE TECHNOLOGY PROGRAM

AN entirely new career classification known as "Veterinary Science Technology", has recently evolved due to the continually accelerating requirement for paraprofessional personnel to support and complement the work of research investigators and veterinarians (meat and poultry inspectors, regulatory officers, and practitioners). The rapid development of this vocational field is providing many new technician graduates with meaningful and rewarding job opportunities, educational institutions with an additional curricular training area, and research scientists and practitioners with relief from routine technical duties.

Average citizens are probably not aware of how increasingly dependent they are becoming on the discoveries, products, and services which emanate from the fields of biomedical research and veterinary medical practice. Most of these benefits are taken for granted. Even among those individuals directly affected by the application of new medical and surgical techniques or devices, few have an adequate understanding of how these new approaches were perfected. For example, very few potential recipients of heart, kidney or other organ transplants are aware that this life-extending surgical technique was developed and perfected utilizing research animals (particularly dogs) before application was made to extend human life. Nor is the recipient likely to be aware of the considerable amount of money and effort spent by the research scientist in learning to overcome problems such as the "tissue rejection" phenomenon related to the success or failure of this advanced surgical technique.

Members of our society now experience a longer, healthier life, largely because biomedical and veterinary research scientists have been active in discovering and eradicating many of the causes of infant deaths and crippling or malignant diseases of the elderly. Many new drugs are being investigated yearly in private industrial laboratories. These are then approved by the U.S. Food and Drug Administration and made available to physicians for use in relieving human suffering.

Both our civilian and military populations are fortunate in that each is continuously protected by the most rigorous system for sanitary surveillance of eating establishments and a food and meat inspection service of the highest quality to be found anywhere in the world. These activities, again, are under the direction or responsibility of veterinary or medical health officers.

Externally, our animal agriculture is protected from invasion by diseases foreign to our country through the watchful eye and activities of the regulatory veterinarian. Concurrently, the large animal practitioner administers to the daily health needs of animals which provide us with food, meat and fiber. Other veterinarians specialize in medical care of animals used for exhibition (zoo animals) or entertainment (race and pleasure horses). A growing number of veterinarians are now being employed in medical research institutions to supervise vivarial operations and to provide medical care for laboratory animals used in the research programs of these institutions. The last and largest group of veterinarians is that which services the health needs of the more than seventy million companion animals (dogs, cats, and pet birds). The AVMA (American Veterinary Medical Association) has estimated that as of 1970 there were approximately thirty million families in the United States, each of which owned a dog and/or cat. For servicing the health needs of this huge population of companion animals, there were approximately 3,000 veterinary hospitals and/or clinics available in this country.

Thus, the efforts of the biomedical scientist and the veterinarian are directed toward making the American way of life safer, healthier and more enjoyable. The contributions already made in-

dividually and collectively by members of these professions are likely to be surpassed by future contributions.

SIGNIFICANCE OF THE PARAPROFESSIONAL

Since the early 1960's, it has become increasingly clear that an acute need exists for personnel trained at the technician level to support and complement the activities of this divergent group of medical professionals. The veterinary profession, in particular, can no longer extend the capabilities and expertise of its individual members in serving society, without simultaneously turning over many of the time-consuming, non-professional responsibilities to a qualified body of trained individuals. For example, in addition to providing proper animal restraint, as in Figure 1, the veterinary technician, who is proficient in medical and surgical nursing, radiological techniques, clinical laboratory testing procedures, etc., is relieving the practitioner of the burden of these routine duties.

Figure 1 — A veterinary technician provides restraint for a patient receiving a physical examination.

Likewise, as this country continually increases the size and complexity of its medical research (cancer, heart disease) aerospace research (germ-free technology) and environmental improvement programs, more and more research scientists will be forced to seek technical assistance in carrying out their investigatory work. Veterinary technicians employed in research laboratories are qualified to assist and support the investigator in many ways. Some will oversee the general care and management of laboratory animals to be used in experimental research programs. Other technicians will give more direct assistance to the investigator, such as administering an intravenous anesthetic to an animal involved in a research project, as demonstrated in Figure 2.

Figure 2 — The veterinary technician in a research laboratory administers an intravenous anesthetic to a monkey while an animal attendant assists in restraint.

Past emphasis upon the need for individuals to attain the baccalaureate, graduate, or professional degree has resulted in a relatively large supply of graduates who are capable of serving at the theoretical, supervisory, or top management level of the biomedical-veterinary career ladder. At the same time, there is a rather abundant supply of unskilled labor universally available for this career area. However, the individuals available, due to lack of skills at entry level, are apt to remain occupationally stationary as animal caretakers, animal aides, kennel assistants, etc. The employee turnover at this level is very high. Most of the employee upgrading and acquiring of personal skills is via the slow, arduous route of on-the-job training. Many in this category never achieve the desired proficiencies needed for promotion, either because they become disinterested or possess academic deficiencies as the result of dropping out of high-school programs.

Because of these inequities then, a great void in the biomedical and veterinary career ladders exists which needs to be filled by individuals trained to serve as middle management supervisors. These new types of trained individuals are the veterinary technicians who will be essential in filling the manpower gap between the untrained caretaker and

the highly trained professional. These two-year college educated and trained paraprofessionals are needed so that both the veterinarian and the research investigator can be released for more professional duties. In addition, these same individuals are needed to supervise and provide in-service-training programs for the unskilled. Aside from their responsibilities to persons above and below them on the career ladder, veterinary technicians possess technical skills and proficiencies which are uniquely theirs to perform.

DEVELOPMENT OF THIS CAREER

The U.S. Army, and more recently the U.S. Air Force, has long recognized the advantage of training and utilizing veterinary technicians. While health and animal care emphasis in the military has shifted from horses and mules to dogs, pigeons and laboratory animals, the technician's role and responsibility has increased. Many young veterans, having served in the veterinary corps, are discharged with skills and capabilities enabling them to find employment readily in the veterinary science technology field. Nevertheless, training programs for technicians in the military veterinary corps have been limited to didactic training without the general education component found in the new two-year college programs.

In the allied health professions of human medicine and dentistry, technicians have long been proving their worth. Curriculums for veterinary technicians educated in this country, including the curriculum outlined in this guide, provide training for technical assistance which is more generalized than that of the medical nurse or dental technician. However, the original overall purpose for training these three paraprofessional groups was the same; that is, to provide their professional employers with competent assistance in the routine and technical aspects of their practices. Certainly physicians and dentists could not begin to consider meeting the public's health needs without this paraprofessional assistance. The biomedical and veterinary fields will likewise soon be unable to meet the demands for their services without technical assistance.

In 1961 the Council of the Royal College of Veterinary Surgeons introduced a scheme for the recruitment, training, and registration of Animal Nursing Auxiliaries. The R.A.N.A. (Registered Animal Nursing Auxiliary), as the English graduate technician is known, has similarly received two years of training, but with greater emphasis on work-experience. The R.A.N.A. must also complete "theory" courses in such subjects as Anatomy and Physiology, Management and Hygiene, Diagnostic Aids, Theory and Practice of Nursing, etc. Both theory and work-experience training must be completed at centers approved by the Royal College of Veterinary Surgeons. The great majority of these young ladies (the R.A.N.A. organization is basically a female group) are employed by veterinary surgeons in small animal practice. In the animal hospital they work in the functional areas of medical and surgical nursing, more than do their American counterparts. They have been trained and equipped, however, to perform diagnostic laboratory tests, perform radiological techniques and other hospital duties also. The R.A.N.A.'s high standard of behavior and attention to duty have already earned a great deal of respect and admiration, from veterinary surgeons not only in England, but also in the United States and other countries.

With successful training programs in veterinary science technology firmly established on at least two continents, and considering the excellent performance being demonstrated by graduates and overwhelming acceptance by employers, it should not take long for this new cadre of paraprofessionals to allay the earlier fears of some, regarding possible unethical or incompetent outcomes from formal training programs. Alumni groups of veterinary technology graduates are doing much to foster and improve their own image as well as to help uplift those hospital and research assistants that have never received formal training.

PREDICTION OF FUTURE NEEDS

Statistical requirements, indicating the need for veterinary technicians in the future, are difficult to obtain. The idea of using college-trained technicians in veterinary practice is just now catching on. Many practitioners have had to learn how to deploy the technician's skills properly, before the relationship became profitable. After a year or two of employing these trained assistants, a good number of practitioners have found they cannot function as well without them and immediately replace a loss with another graduate. Practice size and operations vary so widely that one cannot predict the number of technicians that will be employed in any given hospital situation. Someone has suggested one veterinary technician for any three-man practice, yet there are three-

man practices in existence in which each of the three veterinarians utilizes a technician full time. In some very active one-man practices there may be two graduate technicians working full time. It would appear, therefore, that more time is needed for the full impact of trained technician assistance on veterinary practice operations to become manifest. Also, there are a large number of qualified on-the-job trained technicians working in animal hospitals today. Nobody knows how many of these there are, nor how many will be replaced by new graduates of formal veterinary science technology programs.

Appraising the future need for laboratory animal research technicians is almost as difficult. The best information available on this subject is contained in a report of the Committee on Technical Education, ILAR-NRC (Institute of Laboratory Animal Resources-National Research Council) published in 1969 by the National Academy of Science. The report indicated a projected need at that time, for animal care personnel at different levels in college and university research programs throughout the United States to be approximately 32,200 junior animal technicians, 6,100 senior animal technicians, and 1,600 master animal technicians. Since the two-year college trained laboratory animal technology graduate qualifies on a par, at least, with the American Association for Laboratory Animal Science's former senior animal technician classification, these figures represent quite a sizeable demand for this level of technician in research. Since the information this report is based on is already four to five years old, the projected need by now has probably risen considerably. In fact, the Animal Welfare Act of 1970 requires adequately trained animal care personnel to be employed in research institutions.

Figures obtainable on needs for technician support in the regulatory and food inspection service areas of the United States Department of Agriculture are smaller but probably represent more accurate appraisals presently. It is expected that State and Federal regulatory agencies together may have a yearly need for 50 new technician employees. In the area of food inspection, the projected annual need is for approximately 800 new food inspectors.

As the foregoing facts suggest, it is difficult to arrive at a precise estimate of the future national needs for veterinary science technicians. Nevertheless those educators, veterinarians, and research scientists who have been working closely with training programs are overwhelmingly convinced that the future employment opportunities for these graduates will be plentiful!

TYPE OF EDUCATION NEEDED

Today, a high school education is not sufficient for providing the skills, even at entry level, that are needed to perform successfully in the field of veterinary science technology. Training and experience must be made more comprehensive as the veterinary technician's duties include more applied science and greater use of sophisticated scientific and technical equipment and procedures. Ability to make wise management decisions on the job also requires considerably more knowledge of social science and business principles. A minimum of a two-year post high school technical education is, therefore, a necessity to provide an adequate technical and general education.

This curriculum guide is designed to provide a comprehensive approach and the level and quality of instruction which, upon graduation, will insure the interested student a rewarding career in this vocational field. The suggested curriculum, with its option, provides for study in either veterinary science technology or meat inspection and regulatory technology. However, because there is a large scientific and technical base of understanding common to all disciplines within this field, the option in meat inspection and regulatory technology is not exercised until completion of the third semester. The program is very heavily laboratory oriented. Laboratory facilities simulate, as closely as possible, the physical working relationships graduates will encounter in the field.

Programs for educating veterinarians and medical doctors are expensive undertakings. Similarly, college administrators will recognize that providing the kind of educational program needed for training veterinary technicians, may prove to be one of the most expensive training programs on their campuses.

GENERAL CONSIDERATIONS

This guide has been prepared for school administrators or department heads who are considering whether or not to establish post-high school programs in veterinary science technology, or who wish to strengthen an existing program. It was formulated after extensive study, including visits to schools with outstanding, already established programs which educate technicians in

this field. Consultations with teachers, administrators, and representatives of private industry and veterinary practice in each region explored problems, ideas, suggestions, and recommendations on many pertinent aspects of the program. All of these have contributed towards shaping the content of this guide.

Those who believe a veterinary science technology program would serve a need at their institution should first confirm their beliefs through a comprehensive regional, state and local study. It should be conducted with the assistance of personnel representing the professional and scientific societies of the region who are acquainted with the occupational needs in the veterinary and biomedical fields. Such a study is necessary to catalog the educational needs, to define community support, to evaluate the available student population and interest, to determine to what extent existing schools are already meeting the training needs of the region, and to form a basis therefore, for a decision as to whether the program is sufficiently needed to warrant offering it.

It is expected that some institutions which establish programs using this guide will desire modifications to better fit the local conditions and skill requirements. However, it is suggested that school administrators and teachers seeking to add or to delete courses or parts of courses should consult the local advisory committee and representatives of the State Veterinary Medical Association so the resulting program will truly reflect existing local or regional needs. It is very important that a program of this type should not be undertaken without most of the recommended facilities, equipment and necessary instructional staff. Even with the best facilities and equipment, highly effective teaching is necessary to make the program a successful one.

Technical programs in Veterinary Science Technology are presently being offered in several types of post-high school institutions in the United States. They can be found in two year community or junior colleges, technical institutes or colleges, area vocational and technical schools, and in divisions of four year colleges or universities. Careful study of the curricula and program operations currently in effect at a selected number of these institutions, together with suggestions and advice received from consultants recognized as experts in this career field, reveal that the following questions should be answered in the affirmative before this type of training program is undertaken:

(1) Is the program an educational objective which the administration and staff of the institution understands and will support with staff, money, and cooperation?
(2) Is the present faculty, if any, qualified; or can such staff be obtained?
(3) Will there be adequate financial support to provide the program with buildings and facilities and to maintain it by providing the proper tools, books, instruments, and equipment necessary for a high quality program?
(4) Will provisions be made for effective guidance and placement services?
(5) Will such a program meet a need in the state or community at a reasonable cost?

OCCUPATIONAL OPPORTUNITIES

Graduates of this program can expect to find employment opportunities open to them in many diverse areas of the veterinary and bio-medical career fields. Each area may offer slightly different requirements, but most of the differences can be adapted to through on-the-job or part time study. The list that follows has been reviewed by educators and by employers. They are in general agreement that these jobs are examples of work that graduates would be prepared to do at the entry level. The titles may differ in some areas, and may be subject to change as work requirements change and new positions are created.

Typical Employment Opportunities

Veterinary Practice Areas
- Equine specialty practice technician
- Exotic species practice technician
- Mixed or large animal hospital technician (food animal production)
- Small animal hospital or clinic technician and supervisor
- Veterinary medical center technician (medical and surgical nursing emphasis)

Laboratory Animal Research Areas
- Biomedical research laboratory technician
- Laboratory animal vivarial services supervising technician
- Pharmaceutical laboratory research technician
- Production manager—laboratory animal breeding establishment
- Salesman for laboratory animal equipment or products company

Educational Areas
- Teaching assistant in biological sciences departments in 2 and 4-year colleges

Teaching assistant in schools of laboratory animal technology
Teaching assistant in schools of veterinary science technology
Teaching assistant in veterinary medical colleges

Regulatory Veterinary Medicine and Public Health Areas
Animal health program technician
Animal Welfare Act inspection and enforcement officer
Agricultural quarantine inspector (air, ocean, border ports)
Environmental science technician
Food and milk sanitarian—local governments
Regulations compliance officer

Meat and Food Inspection Areas
Federal Meat and Poultry Inspector
State Meat and Poultry Inspector
U.S. Air Force Veterinary Service meat and food hygiene technician
U.S. Army Veterinary Service meat and food hygiene technician

Military Service Areas
U.S. Air Force—Laboratory animal technician
U.S. Air Force—Preventative medicine technician
U.S. Army—Base sanitary inspector
U.S. Army—Laboratory technician at Institute of Pathology
U.S. Army—Technician in charge of health care for sentry dogs, etc.

Diagnostic Areas
Commercial diagnostic laboratory technician
Histological technician
Laboratory technician in human hospitals (hematology and chemistry departments)
State—Federal diagnostic laboratory technician
Veterinary college diagnostic laboratory technician

Other Areas
Artificial breeder technician
Nutritional research technician
Peace Corps—animal management and health specialist
Zoological garden—animal health technician

Many of the primary employment opportunities listed above will actually provide several levels of employment possibilities, and there are other closely related job positions too numerous to mention. For example, a graduate applying for work in an animal vivarium might secure a position either as an entry level laboratory animal technician or, with experience plus his training, as a laboratory animal supervising technician.

Generally speaking, new graduates of this program would be expected to gain positions listed at entry level. It is assumed in most cases they will advance on the job to higher positions as a result of work-experience and further study. After training programs have been established, there should be in-service education available to the graduates in the evenings or at times when they can enroll without interfering with their work.

SPECIAL ABILITIES REQUIRED OF TECHNICIANS IN GENERAL[1]

Technicians must have the following special abilities:

(1) Proficiency in the use of the disciplined and objective scientific method and practical application of the basic principles, concepts, and laws of physics and chemistry, and/or the biological sciences as they comprise the scientific base for the individual's field of technology.

(2) Facility with mathematics: Ability to use algebra and elementary statistics as tools in the observation, definition, or quantification of scientific phenomena or principles.

(3) A thorough understanding and facility in use of the materials, processes, apparatus, procedures, equipment, methods, and techniques commonly used in the technology.

(4) An extensive knowledge of the field of specialization with an understanding of the application of the underlying physical or biological sciences as they relate to the engineering, health, agricultural, or industrial processing or research activities that distinguish the technology of the field. The degree of competency and the depth of understanding should be sufficient to enable the individuals to establish effective rapport with the scientists, doctors, managers, researchers, or engineers with whom they work and to enable them to perform a variety of detailed scientific or technical work as outlined by general procedures or instructions; but requiring individual judgment, initiative, and resourcefulness in the use of

[1]Adapted from United States Department of Health, Education, and Welfare, Office of Education publication, *Occupational Criteria and Preparatory Curriculum Patterns in Technical Education Programs.* (OE-80015) Washington, D.C.: U.S. Government Printing Office, 1962, p. 5.

techniques, handbook information, and recorded scientific data.

(5) Communication skills that include the ability to record, analyze, interpret, and transmit facts and ideas with complete objectivity orally, graphically and in writing.

(6) Leadership and personality characteristics conducive to good interpersonal relationships.

ACTIVITIES PERFORMED BY TECHNICIANS IN VETERINARY SCIENCE TECHNOLOGY[2]

The veterinary science technicians will use the six special abilities as they perform some or all of the following activities. It is the combination of these activities that defines the technician's field of specialization and course of study. Some of the activities are broadly inclusive, others describe very specific job functions. The technicians may:

(1) Apply knowledge of science and mathematics extensively in rendering direct technical assistance to veterinary and bio-medical scientists engaged in scientific research or experimentation as demonstrated in Figure 3. They may help conduct laboratory and/or field studies in developing new drugs, breeds and strains of laboratory animals, diagnostic or analytical equipment, or medical and surgical procedures.

(2) Design, develop, or plan modifications of new products, procedures, techniques, processes, or applications on his own or under the supervision of a veterinary or biomedical scientist in applied research, design, and development.

(3) Plan, supervise, or assist in installing or assembling complex apparatus or equipment and control systems used in veterinary practice, the research laboratory, teaching institutions, or in slaughter and processing facilities.

(4) Advise concerning, or supervise, the purchase, operation, maintenance, and repair of complex equipment and medical and research instruments to obtain maximum operating efficiency.

(5) Plan production or operations as a member of the management unit or as the person responsible for efficient use of manpower, materials, money, and machines used in animal health care and laboratory animal production.

(6) Advise, plan, and estimate costs as a field representative of a manufacturer or distributor of technical apparatus, equipment, services, or product. Or he may need to advise, plan, or estimate costs on renovation or new construction of buildings, facilities and environmental controls for animal hospitals or laboratory animal vivariums.

(7) Perform determinations, analyze and/or test biological and pharmaceutical products in the hospital or in the research laboratory. He may prepare appropriate technical reports covering the tests or make management decisions as a result of them.

(8) Prepare or interpret drawings or sketches of buildings, equipment, or environmental control systems and write detailed specifications or instructions to accompany them.

(9) Read, select, compile, and use technical information from references such as professional journals, operation manuals, handbooks, and scientific journals.

(10) Analyze and interpret information on quality control, percent compositions or adulterations of meat and meat by-product samples as tested by precision measuring and recording instruments.

(11) Analyze and determine technical problems that involve independent decisions. Their judgment may require technical ability and practical experience to arrive at decisions.

(12) Deal with a variety of technical problems involving many factors and variables which require an understanding of several technical fields. They must know how to go about solving a new problem, including locating sources of pertinent information. This versatility is a characteristic that relates to breadth of applied scientific and technical understanding, the antithesis of narrow specialization.

The foregoing activities do not include functions or activities that are the *special prerogatives* of recognized professional or skilled worker groups. The technician, however, must be familiar with the work of the research scientist, practicing veterinarian, and regulatory or meat inspection veterinarian, since they may work with any of them in performing their duties. Few, if any,

[2]Ibid.

Figure 3—A research scientist has administered a drug undergoing investigation to the rat. The effects of the drug injected are being observed and noted by the veterinary technician who is determining the rat's blood pressure utilizing sophisticated laboratory equipment.

technicians perform all twelve activities, but the work of all technicians requires some combination of them.

A two-year program must concentrate on primary or fundamental needs if it is to prepare individuals for responsible technical positions in or related to the veterinary and bio-medical fields. It must be realistic and pragmatic in its approach. *The program suggested in this guide has been designed to provide maximum technical instruction in the time that is scheduled.*

To those who are not familiar with this type of educational service (or with the goals and interests of students who elect it), the technical program often appears to be inordinately rigid and restrictive. While modifications may be necessary in individual institutions to meet regional or local needs, the basic structure, content, level, and rigor of this program should be maintained.

Most of the specialized technical courses in veterinary science technology are laboratory-oriented. They provide application of the scientific principles being learned concurrently in courses in mathematics, chemistry, and introductory microbiology. *For this reason, mathematics and science courses must be coordinated carefully with technical courses at all stages of this program.* This coordination is accomplished by scheduling mathematics, science, and technical courses concurrently during the first two terms. General education courses constitute a relatively small part of the total program. It has been found that students who enter a technical program do so because of the depth in the field of specialization that the program provides.

FACULTY

The first faculty member employed in an instructional program in veterinary science technology is likely to also become the program director. With this in mind, the individual considered should be a Doctor of Veterinary Medicine. There are several reasons for making this choice. The principal faculty member should be very familiar with what will be the student's needs for theoretical knowledge and practical skills in order to give proper guidance to the program. An experienced practitioner would have this knowledge and also be able to order the proper equipment and instruments at the inception of the program. The AVMA has recommended that program directors be veterinarians, and that veterinarians should be employed as part of the full time teaching faculty to insure the proper indoctrination of students in the scope, limitations and ethics of practice which apply to qualified technicians.

The AVMA is in the process of accrediting training programs of institutions who are graduating veterinary technicians. This accreditation program, of course, would be on a voluntary participation basis. Since any institution that desires to serve the veterinary profession by training paraprofessional assistants for its use, will desire an accredited status, it would be well for administrators to keep in mind the AVMA recommendations when recruiting for faculty. Another advantage in program directors being veterinarians is that they already have many contacts with colleagues and officials of the State and National Veterinary Medical Associations with whom they might develop a liaison for the program. These contacts will be important in gaining employer support for placement of graduates, in achieving satisfactory salary schedules for graduates, in securing some kind of certification or recognition of graduate competence, and in finding encouragement and support from practitioners for improvement of the training program.

In addition to the qualifications of the program director, there are other general considerations that should be made concerning faculty. It is well known that the effectiveness of a program of this type depends largely upon the competence and enthusiasm of the teaching staff. It is important, therefore, that the college dean or other administrator responsible for faculty selection be aware of the specialized competencies that are required of the teacher due to the nature of the curriculum. Technical program teachers must

possess a larger base of technical knowledge than the high school instructor, but are usually less specialized than instructors of graduate courses in universities. They must be teaching-oriented in contrast to research-oriented in their work. They should be masters of the skills in their specialty; have a practical knowledge and yet the academic background to understand and interpret related technical information. To be successful in this level of instruction, they must also understand the special educational philosophy peculiar to technical education.

In working with today's youth, instructors in this program must be intellectually honest, have a positive, lively interest in their subject matter, and present material that is relevant and up to date. They must understand and appreciate the need for technician training in his field. Students expect their instructors to be proficient in the skills and techniques they are required to learn. Any faculty member serving as a student advisor in this program should possess mature judgement and emotional stability. There are many students enrolled in college today that fail or drop out because of various types of personal problems rather then because of intellectual deficiencies. A good advisor must show concern and provide personal as well as academic advisement.

Instructors who teach in this technical curriculum may be one of two types. The first is the full-time professional teacher, who is professionally prepared, with at least a minimum of teacher education courses at the university level, and devotes full time to the technical program. In selecting this kind of teacher, the administrator should look for former students who have completed a related university program. Baccalaureate degree technologists with backgrounds in biology, animal or veterinary science or teachers who have interned in technical programs or spent considerable time at work in the veterinary or laboratory animal fields also make good candidates. Veterinarians who wish to leave practice, meat inspection, regulatory work, or the military for an instructor's position in a school of veterinary science technology may be suitable prospects if they are still proficient in their practice skills and are interested and able to relate to the two-year college age student. It is often a temptation for administrators to hire newly graduated veterinarians because of the lower salary they will accept and because of their ability to relate well to the two-year college student. However, in some cases their lack of experience in the field may weigh more heavily against their selection.

Another very good source of veterinary instructors would be officers being discharged from the military service. These veterinary officers have already gained much experience in training and utilizing veterinary technicians under their command. Individuals, who have been trained in a two-year school of veterinary science technology and proceeded up the educational ladder to earn the Doctor of Veterinary Medicine degree or graduate degree in some area of research, would probably make one of the best choices for instructors, since they would have the understanding and the proper perspective on the role of both the technician and the professional.

Where two-year technical programs are located on the same campus as a veterinary college it would be practical and wise to investigate the possibility of members of the professional staff of the veterinary college teaching a number of the clinical skills and techniques to technical students. This is now occurring in at least two veterinary colleges in this country with very gratifying results. It has been reported that a definitely favorable rapport is quickly developed between professional and technical students and that each gains through learning and understanding the other's role in practice. It is certain that this innovative development in veterinary technical instruction will help improve the technician's education and further the understanding of the role of the paraprofessional in veterinary medicine.

The other type of teacher is the part-time instructor from a veterinary—biomedical industry closely related to the technical program. Part-time teachers from industry may be employed to teach courses requiring special skills or knowledge. They may be prospective employers of students or former students working in industry. Sometimes it is possible to obtain people who have had teaching experience prior to going into industry.

Both full-time and part-time instructors may be used to make up the staff. Part-time teachers from industry may bring needed technical knowledge not possessed by the others. Full-time teachers, however, should comprise the large majority of the faculty for this program. They will usually be better able to advise and counsel students and to help part-timers with teaching methods and classroom management.

In all technical programs there should be a team approach to teaching, with close liaison maintained between the various staff members. Coordination of course content should be discussed at

staff meetings. Concepts taught in basic science classes should be reinforced in advanced classes by practical examples and application. This close liaison should also be maintained with the teachers of general education subjects. Student weaknesses in communications should be as much the concern of technical teachers as it is of the language teacher.

Another member of the team should be the librarian. The librarian responsible for technical education should be included in staff meetings and curriculum discussions whenever possible. This important two-way communication will apprise the librarian of what materials are needed, and teachers of what new materials are available.

The philosophy of the team approach is to emphasize the cohesiveness of the program. The aims and objectives are: immediate employment, advancement on the job, social competency, and citizenship. They can best be accomplished by an educational program that combines technical knowledge, skills, and general education in a meaningful program.

Faculty members should be encouraged to develop technically and professionally. This can be accomplished by offering release time and financial assistance for in-service training. The in-service training program should be developed to strengthen individual weaknesses. One teacher may profit more from summer employment in industry, while another should attend formal classes. Additionally, faculty positions should provide professional challenges and should be financially attractive to assure the stability and competence of the faculty.

In-service teacher training is very important in schools which are changing from vocational programs to technical programs while using the same staff. It is also necessary in schools where university staffs, who are accustomed to teaching in the four-year or professional program, teach part time or full time in a technical program. In each case, the aims and objectives, subject matter presentation, and philosophy are different. The administrator should be certain that the teaching staff is oriented to these important differences and that individual staff members are allowed time to prepare for the new teaching role.

All technical teachers should be encouraged to maintain close liaison with professional and technical societies related to their teaching speciality. Attendance at society or organization meetings provides opportunities for the teacher to keep abreast of new developments. This is important also for placing graduates in suitable employment.

The workload of the technical teacher should preferably be less than fifteen and not more than twenty hours per week. Due to the mixed lecture and laboratory schedule, it is sometimes difficult to compare this teaching load with that of non-technical teachers in the same school. A comparison is sometimes made by counting one lecture hour or a two-hour laboratory period as one teaching unit and a three-hour laboratory period as two teaching units. However, these comparisons are difficult to make. The time required to prepare adequately for a laboratory period and do the required follow-up work may in some cases exceed that needed for a lecture hour.

The size of lecture classes will vary with the subject matter being taught. In lecture classes, it may be possible to have forty to fifty students. In classes where demonstrations or specimens are used, the class size should be limited to the number that can readily observe what is being shown. Laboratory classes should be limited to between twenty and twenty-four students. This allows the students to see the laboratory materials and the instructor to give more individual attention. In any case, the smaller the laboratory class section, the greater will be the amount of information and skill preparation transferred to individual students.

Good laboratory classes require much time in the preparation of materials and equipment. Whenever possible, it is desirable to use laboratory assistants to help the instructor with laboratory preparation and procedure.

The curriculum outlined in this guide will require a faculty of seven to nine members. A minimum of four is needed to teach the veterinary science technical courses (including the department head teaching at least part time) if no option is offered. If the option in meat inspection and regulatory technology is offered, then a minimum of six full-time veterinary science technical instructors will be required. In addition, there should be the equivalent of three full-time faculty for instruction in mathematics, science, communications (language skills), social sciences and the auxiliary and supporting technical courses.

Since the requirement for graduate veterinarians or laboratory animal scientists as instructors is great in this program, perhaps some part-time personnel could be utilized to complete staffing requirements. A staff of this size provides instructors with the required specialization in the technical subject and permits instructors and the

department head to spend some time in job placement. For purposes of fiscal planning the program can be initiated with one instructor in addition to the department head. However, the remaining technical faculty members will need to be appointed at the beginning of the second year of the program's inception.

The faculty and facilities suggested in this guide are intended to accommodate a beginning class of thirty students. Allowing for reasonable attrition, it can be expected that about twenty students will start the third semester of the program.

STUDENT SELECTION AND SERVICES

While the effectiveness of a technician education program depends greatly upon the quality of the faculty, student selection is equally important. Only well prepared, highly motivated and qualified students will successfully complete this curriculum, obtain employment as beginning technicians, and grow into larger responsibilities. They must want to work in the veterinary-biomedical career field and recognize the need for extensive technical training to achieve success.

Many post high school institutions have an open-door policy, wherein all high school graduates are eligible for admission to the college. The open-door policy has merit in that any high school graduate is given the opportunity to enter post high school education. However, the open-door policy should not be interpreted to mean that all who enter the institution can expect to succeed in a rigorous technical program. The importance of some system of selection of students who have a reasonable expectation of succeeding in the program cannot be overemphasized. Schools which are changing from vocational to technical programs must have new curriculums which achieve the rigor of the technical level. New schools offering a technical program must select students who can master a high level of technical instruction from the beginning.

In cases where unqualified students are allowed to enroll, the students will usually fail or the level of instruction may be lowered. If the level of instruction is lowered, high-quality technicians with the depth and breadth of preparation required for employment will not be attracted. In either case, students or employers soon become disillusioned and the whole program is endangered.

Another reason for setting selection standards for students is that it adds strength and potential quality to the program. Students and their parents find the technician objective attractive when they appreciate that it is a special objective which requires high scholastic standards. As it has been pointed out in the section on Special Abilities and Activities of Technicians, the technician does need special skills and abilities that challenge the best efforts as well as the deepest interest of students. The fact that student selection does take place and that students must do good work to enter and to remain in the program is an important feature in representing the program to students, parents, and prospective employers.

For these reasons, a good counseling and guidance program is necessary. This should start before the student enrolls, preferable at the high school level. Brochures or catalogs which show the program and the pretechnical training required should be distributed to high school counselors. They should also be made available to counselors who may be advising older students or adults.

This program is designed for students with particular interests and abilities in working with animals and/or in medically oriented jobs. In addition, they will need an ability to communicate fluently, solve mathematical problems, get along easily with all kinds of people, and have certain mechanical and manipulative abilities. The recruitment and admissions program should be designed to select students with these interests and abilities.

Those students who plan for their career in veterinary science technology early, should map out a high school course of study which is college entrance level and includes a considerable amount of mathematics and science background.

The entering student should have completed two years of high school mathematics, including one year of algebra and one year of geometry, one year of biology, and one year of chemistry, including laboratory experience or the equivalent. For those students who have not completed the equivalent of these courses, many post high school institutions offering technical programs offer a pretechnical program.[3] The pretechnical program, which includes up to a year's work, gives promising but unprepared students an opportunity to prepare and to prove that they are ready for a technical program.

Most post high school institutions administer some type of achievement test to all incoming students. Tests can be used as an indication of ver-

[3] U.S. Department of Health, Education, and Welfare, Office of Education. *Pretechnical Post High School Programs, A Suggested Guide.* (OE-80049) Washington, D.C.: U.S. Government Printing Office, 1967.

bal and mathematical ability, and to some degree, mechanical ability; but should not be used as major criteria for student selection. Many of the promising students may not have developed the abstract tools of language, numbers, and science required to do well in tests, but can use the tools as needed to serve their vocational interests.

The school admissions officers should have at their disposal the high school transcript showing subjects taken and grades received, various test scores, and grades in pretechnical courses, if taken. In addition, it is recommended that a personal interview be held with each applicant by a faculty member of the technical program. Such an interview can be of value to determine seriousness of purpose and motivation. Motivation is difficult to measure, but is necessary for success in the program.

It is very important for candidates for this training program to have a fundamental understanding of what veterinary assisting or laboratory animal care and research assisting is all about. If they do not, once they begin their classes they may become disillusioned due to certain personal "hang ups" or idiosyncracies, such as allergies to various animal species, inability to work with or see blood drawn, or inability to perform in anatomy cadaver dissection.

Students should learn to recognize and accept in the beginning their own deficiencies, if any, and understand that all is not glamour behind the front desk of the veterinary medical hospital. Therefore it is desirable that applicants have had some kind of work-experience.

Another effective method for personnel responsible for the admissions process to gain insight into an applicant's motivation and seriousness of purpose is to require a letter, composed by the applicant, stating why he (she) desires entrance into the veterinary science technology training program. It is always wise to require letters of recommendation from former employers or professional persons who are familiar with the applicant and his (her) family. Such a letter will aid in evaluating the student's maturity, seriousness of purpose, and work habits. Qualified women applicants should be fully advised about the career potential of the technology and encouraged if they desire to enter the program. *However, all students should be strongly advised and counseled that this technical program is in no way a substitute for the conventional Pre-Veterinary Medicine program.* The student should clearly understand that this program prepares primarily for occupational employment.

Effective guidance and counseling is essential. In addition to each student having a regular counselor, it is desirable to have a member of the veterinary science technology faculty available for guidance as an advisor. Students often develop a close relationship with the technical faculty advisor and he can help the student with many of his problems. The faculty advisor can be of special value during times of personal or academic problems or during registration time.

Some type of orientation program for new students is desirable. This can be done before school starts or at the beginning of the term. The orientation program should include campus tours to acquaint students with the campus, plus talks by administrators and student personnel representatives regarding campus rules and regulations. A library orientation to acquaint students with the use of library facilities is a very important part of the orientation program.

The placement of students in suitable and attractive employment upon graduation is a vital part of the program. Placement of graduates gives meaning to the whole program. A good record of placement helps motivate current students and helps attract new students. It is also desirable that students be placed in summper employment between the first and second year of the program. These jobs should fit the occupational objectives of the students to allow them to have real work experiences before graduation.

Job placement can be managed in various ways. Experience has shown that individual instructors can do much of the placement work. During visits to veterinary hospitals, pharmaceutical laboratories, medical centers, or advisory committee meetings, the member of the instructional staff should always keep placement in mind and be prepared to make recommendations when employers ask for help.

Periodic followup studies of previous graduates should be made. This can be done by questionnaires through the mail or by personal visits to places of employment. A check on the progress of graduates offers a good means of curriculum evaluation and can be used as a basis for improvement of the program.

Another part of the student service program is the sponsoring of a departmental student organization. Student club activities offer a good medium to utilize important speakers, to show good films of general interest, and to teach group dynamics and parliamentary procedures. Student organizations can be helpful in sponsoring field

days or open house for guests from local high schools, 4-H veterinary science, or explorer scout groups. Student club organizations have been found to be helpful in developing leadership qualities in students.

Each student should be given the opportunity to become acquainted with members of technical societies or professional groups in his area of specialization. Many technical societies offer student membership rates. Contacts with these groups help the student become acquainted with people active in the field and with trade publications. Such contacts may eventually help the student in finding employment, and they provide a future source of technical information.

An associate degree or comparable certificate should be conferred by the institution to indicate the student's successful completion of the program. This may be presented at graduation or some similar ceremony held to recognize achievement. Outstanding individual achievement also may be recognized at this time or at a banquet or meeting of the student organization.

TEXTBOOKS, REFERENCES, INSTRUCTIONAL MEDIA

Textbooks, references, and instructional media must be reviewed constantly in light of new developments in science, agriculture, medicine, and teaching methods. The impact of developments in science applied to the medical fields is demanding fresh textbooks, articles in journals, and teaching materials.

Departures from teaching the traditional college course in various subjects also are creating a need for new and different books and references. Since there are practically no texts developed yet for the two-year student in this technology, instructors must glean from professional texts in the medical and veterinary fields and translate the information found there into language understandable to the student. A limited number of texts designed for the veterinary science technology student are just beginning to appear, but many more are needed. New texts which are now available and relevant to this curriculum have been suggested in the course outlines and appear in the bibliographical listing.

The teacher should familiarize himself with the available books before selecting that best suited to the particular needs of the students as a text. But in many courses, it will be necessary for the teacher to develop his own teaching materials. It also may be necessary for students to read from many different sources in the library rather than to have one assigned text.

In a changing technology, knowing how to find information is as important as knowing facts. The growth and success of the graduate technician will depend in large measure on his ability to keep abreast of changes in his field. Therefore, students should be encouraged to use the library to look up materials and to become acquainted with sources of information. Class assignments in the library may be necessary to familiarize the student with its use.

Instructional media may be a great help to the teacher when they are pertinent to his teaching objective. Only a few have been listed in this guide because of changing techniques and procedures which tend to make films obsolete in a relatively short time. Teachers should preview all visual aids before use in order to determine whether they will fit the instructional plan. At times only part of a film might be used to demonstrate a point. If so, the film should be set up in the projector before class to conserve time.

New types of instructional media are being developed and should be considered whenever possible. Specifically, research is now being conducted by a committee under the auspicies of the American Institute of Biological Sciences for the development of *teaching modules* (which includes instructional media) which are soon to be available to this technology.[4] Inquiries concerning the progress of this research should be made directly to *Project BIOTECH*, A.I.B.S., 3900 Wisconsin Avenue, N.W., Washington, D. C. 20016. In some new schools the buildings are being planned for educational television. Video tapes of demonstrations or procedures can be produced now for about $1 per minute or approximately $50 for a class period. Video tapes can be used in the library for individual study by students. Strong consideration should be given to use of video tape capability in this program. It enhances total class instruction in detailed techniques which otherwise must be demonstrated in very small group sessions.

Administrators and teachers should check with the local telephone company in regard to amplified phone conversations in classrooms. Where applicable, such as in general and industrial economics or animal hospital procedures, it is possible to have pre-arranged telephone conver-

[4] Busser, John H., "BIOTECH", *BioScience, Vol. 22, No. 5*. Washington, D.C.: American Institute of Biological Sciences, May 1972. This article describes the concept and uses of the "teaching module".

sations with experts in any part of the country for a relatively small charge.

Many new audiovisual devices are now available, and new ones, including auto-tutorial devices, are gaining more general acceptance. All such teaching aids should be thoroughly studied by teachers and administrators before investing money in them. Staff members need to be adequately prepared in the use of equipment or materials before effective presentation can be made to students. The unit cost in relation to educational effectiveness should be a prime consideration before purchase.

LIBRARY

A central library under the direction of a professional librarian is important to the success of the teaching of technology curriculums. Most instructors have private libraries in their offices from which they may select books of special interest in their personal conferences with students and thereby stimulate interest in related literature. However, a central library, headed by a professional librarian, insures the acquisition and cataloging of the library content according to an accepted library practice and provides the mechanics for location of reference materials by the use of systematic card files. It also provides the mechanics for lending books to students in a controlled and orderly manner typical of libraries which they may encounter after leaving school.

Study space with suitable lighting and freedom from outside distraction should be provided in the library for short-term study of reference data, and provisions for checking out of reference materials for out-of-library use should be systematic and efficient. The content of a library must provide adequate material in all subjects in the curriculum, and should extend somewhat beyond the degree of complexity or depth encountered in classroom activities. Literature dealing with highly specialized aspects of the various subjects may be acquired as needed or may be borrowed by the librarian from more comprehensive libraries.

The teaching staff and the library staff should actively cooperate with one another. The teaching staff must cooperate with the library staff on materials to be acquired and should be responsible for the final selection of materials that support their technical courses. It must take the initiative in recommending new library content to keep it current, pertinent, and useful. In addition to reference books on all important aspects of veterinary, laboratory animal, and regulatory and meat inspection technology, the library should contain current magazines pertaining to the field and related agricultural fields, bulletins and information from the local extension service, and a wealth of trade and commercial literature.

The library staff should periodically supply the teaching staff with a list of recent acquisitions complete with call numbers. Technical, trade, and association journals should either be circulated to the teaching staff or be placed in a staff reserve area for a short time before they are made available for general library use.

In addition to reference materials, journals, and trade publications, a library should have material of an encyclopedic nature available for quick reference, and should maintain reference index material. The course outline for Communication Skills presents a comprehensive list of periodical indices which should be helpful.

Instructional media may be centered in the library. These should be reviewed and evaluated by both the librarian and a member of the teaching staff as they become available. This procedure will insure that appropriate visual aids are acquired by the library, and should familiarize members of the teaching staff with exactly what is available and where these aids may best be used in the technical programs. Visual instructional media should always be previewed and analyzed for timeliness and pertinency before being used in a teaching situation.

More and more libraries are becoming comprehensive learning centers with individual student carrels, multimedia learning materials, and programmed learning materials for a variety of subjects. It will be noted that the laboratory facilities suggested in this guide have also made provision for the inclusion of nine study carrels.

All instructors should be encouraged to build up a collection of colored slides illustrating principles, concepts, and techniques to be presented in their specialized subject area. These may also be kept in the library.

A well-equipped, modern library should have some type of duplicating service available so that copies of library materials may be obtained easily by students and staff. This service allows both student and staff to build up-to-date files of current articles appropriate to the courses in a curriculum. This service should be available to the students at minimum cost and, within reasonable limits, free of personal cost to the staff.

A list of suggested texts and references may be found at the end of each course outline. In order to

provide a current list, new books over 10 years old have been included. In cases where books over 10 years old are still considered current, a notation to that effect has been made. It should be possible to select suitable texts or references from the lists presented. However, it should not be assumed that unlisted books are not suitable. There are, no doubt, others which are excellent.

LABORATORY EQUIPMENT AND FACILITIES

Specialized laboratory facilities, equipment, and materials for this program are very expensive in comparison to those for other technician training programs. In addition, the animal holding facilities needed to support the laboratory aspects of this curriculum have rigid legal requirements (Animal Welfare Act — P.L. 89-544) for environmental control. These requirements also add substantially to the cost for providing optimum training experiences for students in this program.

Nevertheless, a well-equipped laboratory is necessary to provide for valid laboratory experiences basic in nature, broad in variety, and intensive in practical experience. The technician program should include equipment that illustrates principles used in radiological techniques; surgical assisting (large animal and small); restraint; sampling, weighing, and measuring; clinical laboratory testing; demonstration of physiological functions; anesthesiology; histological techniques; germfree technology; slaughtering and meat processing; and regulatory techniques.

Variety and quality of equipment are more important than quantity. Each piece of laboratory equipment should be considered carefully before purchase. A study of types of equipment used in veterinary hospitals and in laboratories in the local area should be made. The ways in which this equipment might be used in laboratory experiences should be considered. Study may show that laboratory models of certain large, expensive machines, such as autoanalyzers, can be purchased and used to illustrate principles.

A list of the various kinds of equipment needed to teach this curriculum is included in a later section. It may seem rather extensive, but it is considered vital to the program, and the curriculum should not be attempted without it. Much of it is used to provide students exposure to and practice in using diagnostic, medical and surgical equipment, such as the X-ray machine shown in Figure 4, which they will encounter in the field. In addition, some of the equipment is excellent for teaching critical thinking, patience, and proper laboratory procedures.

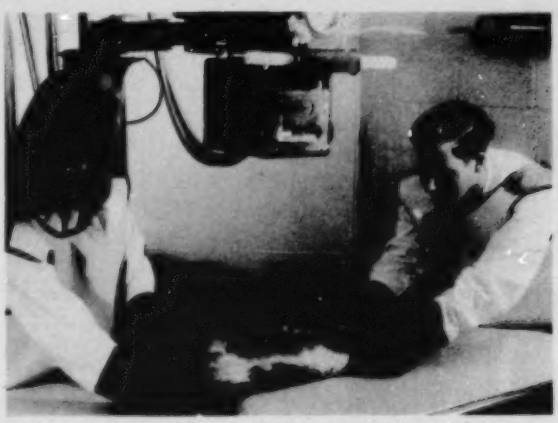

Figure 4 — Wearing protective clothing, students practice proper patient positioning and X-ray machine operation to produce radiographs of diagnostic quality for the practitioner to examine. The X-ray machine is one example of the many expensive and precision type instruments required.

The equipment has also been selected to illustrate principles or concepts. Even though the specific machines will change, if students learn the principles and concepts of a testing procedure they can adapt to new or improved machines.

In addition to the laboratories and equipment suggested in this guide, it is highly desirable if a farm complex is available on the campus for use by instructors in this technology. If not, field trips may be designed and scheduled to local cooperating farms for instruction in large animal assisting and regulatory techniques.

The farm used should be stocked with representative numbers of all the main large animal domestic species, to include if possible horses, cattle (dairy and beef), sheep, and swine. Students will need to become familiar with breeds and strains of these species, as well as restraint, housing, and production methods, and their utility in the veterinary-biomedical fields.

ADVISORY COMMITTEES AND SERVICES

The success of technician education programs depends to a great extent on the formal and informal support of advisory committees.[5,6] When an

[5] American Association of Junior Colleges. *The Role of the Advisory Committee in Occupational Education in the Junior College.* Washington, D.C.: The Association, 1967.

[6] American Vocational Association, Inc. *The Advisory Committee and Vocational Education.* Washington, D.C.: The Association, 1969.

institution decides to consider the advisability of initiating a particular technological program, the chief administrator or dean should appoint the advisory committee. Members can be appointed for regular terms, subject to reappointment, and membership should rotate so that some experienced advisors are present with new ones each term.

The program advisory committee for the veterinary science technology program should be comprised of representatives of veterinarians and researchers who employ technicians, public employment services, scientific or technical societies, and associations in the field, and knowledgeable civic leaders who meet with and advise the specialists on the school's staff. When the program has been operating long enough, it is desirable to add experienced technician graduates to the committee makeup. They provide unique and special insights for evaluating the program. All members serve without pay as interested citizens. They have no legal status but provide invaluable assistance. The committee normally consists of about 12 members (but may vary from 6 to 20), who generally serve for a one to two year period. The head of the institution or the department head of the technology is ordinarily chairman or executive secretary. It should be remembered that persons agreeing to serve are always busy individuals; therefore, meetings should be called only when committee action is needed to handle a specific task or problem.

The committee assists in surveying and defining the need for technicians: the knowledge and skills they will require; employment opportunities; available student population; curriculum, faculty, laboratory facilities and equipment; and cost and financing of the program. When the studies indicate that a program should be initiated, the committee's help in planning and implementing it is invaluable. The program advisory committee should coordinate their activities with the appropriate committee of the State Veterinary Medical Association. Once the program has become well established, its advisory committee may contribute greatly by meeting periodically to evaluate the effectiveness of the curriculum. The group shown in Figure 5 represents a temporarily expanded committee makeup meeting for such a purpose. When students or graduates seek summer or permanent employment, the committee assists in placing them and in evaluating their performance. These evaluations often will result in minor modifications, which more closely relate the program to employment requirements.

Frequently the committee gives substantial help to school administrators in obtaining local funds. Likewise, it may be instrumental in securing State and Federal support for the program.

The advisory committee may use this guide, designed primarily for planning and development of full-time preparatory programs in post high school institutions, as a starting point, modifying it to meet local needs. The program can also form the basis for courses to meet the requirements of employed adults who wish to upgrade or update their skills and technical capabilities. In this way, the school administration, with the help of the committee and special consultants, can effectively initiate the needed program, quickly develop it to a high level of excellence, and maintain its timeliness.

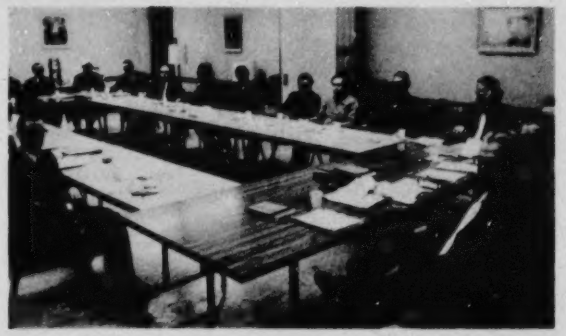

Figure 5—Illustration of a veterinary science technology advisory committee in action. In this case, the group includes not only the Advisory Committee, the Academic Dean and the faculty, but also some employers and graduate technicians engaged in a joint evaluation of the program.

SCIENTIFIC AND TECHNICAL SOCIETIES

Scientific and technical societies and trade associations are an important source of instructional materials and other benefits for teachers and students. Such societies provide, through their publications and meetings, reports and continuing discussion of new concepts, processes, techniques, and equipment in the physical sciences and related technologies. Their presentation and interpretation of scientific and technical discoveries explain the relationship of the theoretical scientist's work to the applied science practitioner's needs. They are invaluable aids in keeping abreast of new developments in a particular phase of science.

Less conspicuous, but extremely important, is the support which societies may give (1) in helping to develop evidence of need for a training program,

(2) in helping to promote the program, (3) in enlisting members' support for the program, (4) in helping to provide work experience for students, (5) in helping with the placement of graduates, (6) in helping the technician Alumni Association in programs of continuing education, and (7) in helping develop certification programs for public and employer recognition of graduate competence.

Associations and societies may supply resource people to act as guest speakers. They also may serve as hosts on field trips when student groups explore specific phases of the industry.

Instructors should be encouraged to become active members in these societies so that they may learn quickly of new technological developments. Membership will also enable them to meet people in the community who are actively interested in the field. Some educational institutions pay all, or part, of the costs of membership dues and attendance at local or national meetings in order to encourage staff participation in selected societies.

Early in their studies students should be required to become acquainted with the literature and services of scientific, technical, and related veterinary and medical societies. They should also be encouraged to join those which offer student-affiliate memberships.

The following is a selected list of societies, associations and organizations which relate to veterinary science technology:[7]

American Animal Hospital Association
American Association for Accreditation of Laboratory Animal Care
American Association for Contamination Control
American Association for Laboratory Animal Science
American Association for the Advancement of Science
American Association of Bovine Practitioners
American Association of Equine Practitioners
American Association of Veterinary Laboratory Diagnosticians
American Association of Zoo Veterinarians
American College for Laboratory Animal Medicine
American College of Veterinary Pathologists
American Institute of Biological Sciences
American Meat Institute Foundation
American Public Health Association
American Society for Microbiology
American Society for Pharmacology and Experimental Therapeutics
American Society of Animal Science
American Society of Laboratory Animal Practitioners
American Society of Medical Technologists
American Society of Parasitologists
American Society of Veterinary Clinical Pathologists
American Veterinary Medical Association
American Veterinary Society for the Study of Breeding Soundness
Animal Health Institute
Animal Medical Center
Animal Nutrition Research Council
Animal Technicians Association
Animal Welfare Institute
Association for Gnotobiotics
Association of American Boards of Examiners in Veterinary Medicine
Association of American Veterinary Medical Colleges
Conference of Public Health Veterinarians
Conference of Research Workers in Animal Diseases
Council of Biology Editors
Federation of American Society for Experimental Biology
Future Farmers of America
Industrial Veterinarians' Association
Institute of Laboratory Animal Resources
International Association of Milk, Food and Environmental Sanitarians
Laboratory Animal Breeders Association
National Association of Federal Veterinarians
National 4-H Service Committee
National Society for Medical Research
Pharmaceutical Manufacturers Association
Society for Experimental Biology and Medicine
Society for Industrial Microbiology
United States Animal Health Association
Women's Veterinary Medical Association

[7]See the Appendix for a brief description of each of these organizations as of 1972.

THE CURRICULUM

Insuring functional competence and success in a field as broad as veterinary science technology assumes several basic requirements which a curriculum must be designed to meet:

(1) Training should prepare the graduate to be a productive employee at the job entry level.

(2) The broad technical training, combined with a reasonable amount of work experience, should enable the graduate technician to accept and perform satisfactorily in positions of increasing responsibility.

(3) The training foundations established in the technical, basic science, and general courses must be broad enough to provide facility for pursuing a program of continuing education and professional advancement within the field, following graduation. In addition to attendance in seminars, workshops, and short courses, this further study may include the reading and assimilation of information from journals, new text materials, or formal advanced course work.

(4) The training boundaries and principles of professional ethics should be presented clearly. In this way, there should be no question as to what the graduates' roles will be in the employment situation, especially regarding their relationships with those they serve or work with. Likewise, a sufficient base of technical and professional terminology and an adequate understanding of human relations should be provided to enable the veterinary science technology graduate to effectively communicate with and coordinate between the highly educated professional employer and the unlearned entry level caretaker or kennel assistant.

(5) The technical and general education course offerings must insure a broad relevant orientation which will provide the graduate with a maximum ability to understand, reason, and function in today's highly complex and technically oriented society.

The curriculum suggested here is designed to fulfill these requirements as outlined. It provides the necessary special abilities and proficiencies for entry-level achievement, as well as the tools and facility for on-the-job growth and continued study.

This curriculum is intented as a guide for program planning and development in post high school institutions. It is a suggested guide for a program in Veterinary Science Technology with an option for Meat Inspection and Regulatory Technology which is exercisable in the fourth semester. It is likely that most initiating institutions will start with the veterinary science technology program and may offer in the beginning, or at a later date, the optional meat inspection and regulatory technology program. In some cases, however, the program may be initially designed entirely for meat inspection and regulatory technology; and in these instances, courses may be added later which are required for the complete veterinary science technology program.

The level of instruction anticipated represents a consensus on the level of proficiency and understanding required for success in occupations in which trained manpower is in short supply today and threatens to be even more so in the future. This curriculum reflects the combined efforts of many people — educators, scientists, employers and experts from the veterinary and biomedical fields, and the staff of the United States Office of Education. The overall objective has been to design a training program which would complement and satisfy the needs of graduates where such diverse career opportunities exist as in the Veterinary-

Biomedical career field. On-the-job flexibility and adaptability on the part of the technician should be a natural and significant characteristic of graduates who have received this training.

The curriculum is organized as 17-week college semesters, rather than as college quarters, because it is usually easier to convert a program from semesters to quarters than the reverse. The seventeenth week, however, is for the administering of examinations, and is not accounted for in the curriculum and course outlines.

In a rigorous program of study, such as this one for veterinary science technology, outside study is a significant part of the student's total program. In general, this curriculum recommends two hours of meaningful outside study for each hour of scheduled class time. The laboratory periods are invaluable to the student, since it is here that principles and concepts presented in lecture are illustrated and practiced.

A typical weekly work schedule for a student in the first semester of this curriculum would be: class attendance, 13 hours; laboratory, 13 hours; outside study, 26 hours — making a total of 52 hours per week. While this provides the average student a full study schedule, it is not excessive or unusual for this type of program. All students should be advised at the beginning of the program to budget and use their study time as effectively as possible. Because of the sequential nature of the curriculum in the technical specialty courses, failure in one of the basic courses may preclude the student from advancing in the program until achievement and proficiency have been demonstrated.

VETERINARY SCIENCE TECHNOLOGY CURRICULUM OUTLINE

	Hours Per Week			
	Class	*Laboratory*	*Outside study*	*Total*
First Semester				
Applied Chemistry	3	3	6	12
Applied Mathematics	3	0	6	9
Communication Skills	3	0	6	9
Introductory Microbiology7	2	4	4	10
Introduction to Veterinary Science Technology	2	6	4	12
Total	13	13	26	52
Second Semester				
Applied Microbiology	4	6	8	18
Comparative Anatomy and Physiology	4	6	8	18
Human Relations	3	0	6	9
Technical Reporting	2	0	4	6
Total	13	12	26	51

	Hours Per Week			
	Class	*Laboratory*	*Outside study*	*Total*
Third Semester				
Animal Diseases	3	0	6	9
Animal Management	4	6	8	18
General and Industrial Economics	3	0	6	9
Laboratory Techniques	3	8	6	17
Total	13	14	26	53
Fourth Semester				
Animal Hospital Procedures	3	0	6	9
Animal Nutrition	3	0	6	9
Clinical Techniques	3	8	6	17
Laboratory Animal Methods	3	6	6	15
Total	12	14	24	50

Summer Session — Occupational experience in the veterinary science technology field

MEAT INSPECTION AND REGULATORY TECHNOLOGY OPTION

First, Second, and Third Semesters are identical to those exhibited above.

Fourth Semester				
Animal Nutrition	3	0	6	9
Applied Meat and Poultry Inspection	3	4	4	11
Elements of Meat and Poultry Inspection	3	4	4	11
Regulatory Technology I	3	0	4	7
Regulatory Technology II	3	6	4	13
Total	15	14	22	51

BRIEF DESCRIPTIONS OF COURSES FOR VETERINARY SCIENCE TECHNOLOGY

FIRST SEMESTER

Applied Chemistry

A review of general inorganic chemistry and an introduction to the principles of organic chemistry and biochemistry which apply to the field of veterinary science technology. The laboratory exercises have been chosen to provide practice in making chemical solutions and solving problems involving the use of chemicals as encountered in industry. The art of objective observation and accurate note taking is also emphasized.

Applied Mathematics

The fundamental concepts relating to real number systems, properties of numbers, laws of exponents, linear equations, and application of algebraic techniques to work problems are reviewed. Statistical methods and tools are explored to enable the student to evaluate various kinds of numerical data encountered in the veterinary science technology field.

Communication Skills

A course designed to promote greater competence in reading, writing, talking, and listening. Use of communication skills in interpersonal relationships is emphasized.

Introductory Microbiology

A basic foundation course introducing the student to classification and techniques of identification, culture, and control of bacteria, viruses, and fungi. Laboratory sessions provide for acquiring of manual skills and proficiencies regarding the details of media preparation, inoculation, and microscopic examination of microbial growth. Students become familiar with types of culture media and biochemical tests most commonly utilized in the diagnostic laboratory today. The concept of contamination by microbial organisms is established through culturing of articles in the student's immediate environment (examples: toilet bowl, hand towel, etc.)

Introduction to Veterinary Science Technology

An orientation course which introduces the areas of professionalism, veterinary professional services, and an elementary consideration of veterinary pharmaceutical identification and usage. Additionally, the course prepares for later study in Animal Management and Laboratory Animal Methods by investigating briefly the animal husbandry areas of nutrition, growth, genetics and environmental factors. "Hands-on" experience is gained through laboratory exercises in breeding, nutritional and environmental experiments, practice in preparing drugs and chemical solutions, preparing and examining blood films, performing fecal exams and other exercises which provide a relevant base of reference during the first semester of study.

SECOND SEMESTER

Applied Microbiology

A continued study which investigates the pathogenic and non-pathogenic microorganisms having an important relationship to animal health, dairy and food processing, public health and meat inspection. Diagnostic methods and techniques used for identification purposes, and determination of antibiotic sensitivity or other control of the most commonly occurring pathogens seen in

practice and laboratory animal research, are emphasized in lecture and laboratory.

Comparative Anatomy and Physiology

A basic comprehensive course, designed through a systems approach, to provide a fundamental understanding and appreciation for form and function of the animal body and its parts. Considerable emphasis is placed upon clinical use of a knowledge of anatomy and physiology as it relates to the accomplishment of everyday techniques and procedures performed in a veterinary hospital or research laboratory. Instruction compares and contrasts anatomical and physiological differences between the species reviewed. Live animals, cadaver dissection specimens, and skeletons are utilized in laboratory study to confirm lecture facts and concepts.

Human Relations

A course in which the student investigates the human relations aspects of: securing an appropriate job; functioning as a technician supervisor; maintaining relations with clients, union and other organizational memberships; and addressing the problems posed by employment discrimination. Interpersonal relationships between the technician and professional employer and between the technician and subordinate employees are examined and the methods for establishing good rapport in both directions are outlined.

Technical Reporting

A continuing, but specialized study in the art of communication skills. The course is designed to give students practice in reading and evaluating scientific and technical literature of others, indoctrination in library usage and data retrieval, and opportunities for submitting written and verbal report presentations of their own for group reaction.

Students are encouraged to learn and apply the skills of technical reporting to their areas of special interest within the veterinary science curriculum.

THIRD SEMESTER

Animal Diseases

A course which introduces the student to abnormalities of form and function. A survey is made of different types and specific examples of diseases occurring in the animal body. Emphasis is placed on origin and development of diseases, prevention and control, and the recognition of lesions or abnormal function important to necropsy and inspection procedures.

Animal Management

Basic principles of animal management are explored through lecture discussion, audio-visual presentations, and field trips. Major areas of study include breeds and strains, social and reproductive behavior, feeding methods, housing, principles of animal production and breeding, and programs for maintaining colony or herd health. Demonstration and practice in restraint and necropsy techniques are examples of the practical type laboratory exercises that are scheduled.

General and Industrial Economics

A study of general economic principles, and an analysis of the factors involved in management of personal finances and methods of cost control in a business enterprise. The economic factors which guide governmental spending and fiscal policies relating to the individual citizen are also presented and discussed.

Laboratory Techniques

A fundamental study in the principles and practice of clinical pathology as these relate to the responsibilities of the veterinary technician. Instructional emphasis is placed on laboratory diagnostic techniques and methods utilized in: hematology, blood coagulation, blood chemistry, testing for abnormal liver, kidney and pancreatic function, body fluid examination and parasitology. Laboratory periods are dedicated to development of skills in the processing of tissue samples from patients. Students repeat each clinical pathology test until proficiency is demonstrated.

FOURTH SEMESTER

Animal Hospital Procedures

A course designed to outline and establish the necessary attitudes, understanding and skills

for effective technician performance in an animal hospital. Considerable attention is given to investigating and suggesting methods for relieving the employing practitioner from the more routine hospital matters and providing more time for professional duties. The scope of this course is such that the job functions and responsibilities presented, in addition to those outlined in other courses of this curriculum, complement the requirements for a functional supervising veterinary technician employed in the animal hospital. Topical areas which are emphasized include: orientation to practice and to the veterinary medical profession, principles of ethical conduct, the veterinary technician and his identity, client relations, bookkeeping and secretarial duties, pharmacy operation, veterinary medical nursing, small animal grooming, and the technician as a supervisor.

Animal Nutrition

A broad introductory course which presents the basic principles of nutrition applicable to all classes of domestic and research animals. Topics covered include: the requirements for, synthesis and metabolism of essential nutrients; types, combinations and preparation of various feed stuffs; as well as the subject of feed additives, their use, economic importance, and related governmental controls.

Clinical Techniques

A clinically oriented course designed to provide the student with the necessary skills and proficiencies to assist the veterinary surgeon. Lecture principles concerning techniques in anesthesiology, radiology and surgical assisting are confirmed and reinforced through repeated laboratory exercises in these areas. Instructional emphasis in radiological techniques, is placed on the student learning to properly position patients, expose film, and process exposed radiographs of diagnostic value. In the areas of anesthesiology and surgical assisting, the learning process includes an orientation to pre-anesthetic and anesthetic drugs, skill development in anesthetizing patients with injectable and inhalant anesthetics, preparation of the assistant, the patient, and the operating theatre and equipment for aseptic surgery, direct assisting during surgery, and post-surgical nursing. Maintenance and care of anesthetic and surgical equipment as well as preparation of surgical packs is thoroughly explained and practiced.

Laboratory Animal Methods

A course which continues in the study of animal use and management, but is designed to provide a fundamental understanding and proficiency in experimental methods and techniques employed specifically with laboratory animals. Subject areas in which students are indoctrinated and/or receive practice experience include body fluid collection and withdrawal, infusion techniques, tranquilization, anesthetization, euthanasia, and safety procedures. Skills are also developed in performing endocrinectomies and other surgical procedures on rodents. The concept and requirements of "germfree" technology are investigated in detail. The scope and conduct of this course is such that upon completion, the student will have achieved a working knowledge and appreciation of basic equipment, operation, and management of both conventional and germfree vivarial and research laboratory systems.

BRIEF DESCRIPTIONS OF COURSES FOR THE MEAT INSPECTION AND REGULATORY TECHNOLOGY OPTION

FOURTH SEMESTER

Applied Meat and Poultry Inspection

A course designed to involve the student in actual inspection procedures, techniques and decisions. Lectures outline and explore specific inspection procedures and methods. Concurrently, laboratory sessions in college slaughter and processing facilities permit students to gain problem solving experience and opportunity to apply newly acquired skills under simulated working conditions.

Elements of Meat and Poultry Inspection

A course designed to acquaint students with the general elements of regulatory functions as they apply to meat and poultry inspection. Lecture orientation is achieved through topics which include the objectives of inspection, history, methods used and basic principles of inspection. During laboratory sessions, inspection principles and methods presented in lecture are confirmed and illustrated through student involvement in actual demonstrations conducted by inspection personnel at work.

Regulatory Technology I

A lecture course designed to orient the student to the general activities, practices and procedures peculiar to the field of regulatory veterinary medicine. Subject areas which are outlined and discussed in detail include national animal health programs having economic and human health significance; related authorities, cooperating agencies, regulations, policies; foreign animal diseases and prevention of their introduction into the United States; monitoring the health of transit animals; enforcement of the Animal Welfare Act; and the role of the technician in support of veterinary medical officers.

Regulatory Technology II

A laboratory oriented course designed to add detail and depth to the student's understanding of the duties and role of the regulatory technician. Lecture sessions outline the principles and techniques which are demonstrated or practiced in the laboratory. Maximum use is made of field trips, where facilities are available, to provide practical experience. Regulatory technical procedures studied include animal identification methods; collection and submission of blood and milk samples and ectoparasite specimens to the laboratory for examination and/or testing; appraisal of test-reactor animals; supervision of premise cleaning and disinfection; preparation, use, and disposal of pesticides; investigations of animal quarantine law violations, tracing of infected and exposed animals, and inspection of laboratory animal dealer premises.

CURRICULUM CONTENT AND RELATIONSHIPS

Curriculum content and organization are influenced by the special occupational needs of the graduates, the limited time available to teach the curriculum, and new methods or techniques which seem imminent in the field of veterinary science technology. The technician is expected to demonstrate proficiency in manipulative skills on the job, so that more instructional emphasis is placed on basic concepts and skill development than on theory, as would occur in a baccalaureate program. Wherever possible, course work should be presented in such a way that the student's thought and reasoning processes are sharpened by providing problem-solving experiences. This will help to assure that the student will be prepared to meet new situations as they arise on the job.

Because the program is of only two years' duration great care was taken in selecting and arranging subject matter in this curriculum. While more general education orientation might seem desirable, it is impossible to include all of the chemistry, mathematics, biology, and social science typical in a four-year program. Therefore the course outlines in these areas have been tailored to reflect a very applied approach. The principles and concepts which relate most directly to techniques performed in veterinary science technology are stressed. The technical study courses are designed to reinforce the concepts learned in each of the specific general education courses. For these reasons, the sequence of courses shown in the curriculum is important. In fact, the sequence of all courses included represents a series of building blocks of knowledge; each semester's work, adds measurably to the student's scope of understanding and level of competency, culminating at the end of two years in a highly functional graduate. Failure in basic course work, therefore, may preclude the student from regular progression and graduation from the program.

Skills, techniques, and applied principles needed by the technician can best be taught through laboratory experiences. Organized and related ideas, concepts, and factual information can be presented most efficiently to large groups during lecture sessions. Therefore, there must be a special relationship between the kind and amount of the scientific and technical specialty taught in the theory classes and that presented in the laboratory. To provide lecture information in an interesting and relevant manner, maximum use should be made of current films, filmstrips, 2x2 colored slides, video tapes, selected texts and references, and guest speakers from potential employment areas. Some method of monitoring student progress in course work should be established to insure regular and systematic outside study on the part of the student. Good study habits should be acquired early in order to achieve in any rigorous technical program such as this one.

It has been proven essential that some specialized technical course work be introduced in the first semester. Two important advantages occur from an early introduction of the technical speciality:

(1) Students who enroll to study veterinary science technology start their training immediately in this specialty. If their first semester consists entirely of general education subjects — mathematics, English, chemistry, etc. — they often lose the interest they originally had, particularly if they have a propensity for skill acquisition, as opposed to theory.

(2) The students begin at once to acquire a foundation of terminology and facts upon which a greater depth of understanding is achieved in specialized subjects in the later stages of the two-year program.

Safety and careful workmanship are stressed throughout the course of study. There are potential dangers involved in any technician's work. By observing normal safety practices, whether working with caustic chemicals, ultra-sharp cutting instruments or with vicious and mean-tempered animals, many dangers can be avoided.

While the importance of protecting human life and limb cannot be overstressed, students also need to learn good work habits and to develop a pride in workmanship. On the job, the technician may become involved with operating highly expensive and delicate diagnostic equipment, may be asked to care for laboratory animals valuable to the outcome of some significant research project, or be assigned to nursing a client's hospitalized and critically ill companion-animal. In all instances, any mistake in carrying out precise operational orders or neglect of duty or attention to detail, may result in loss of time, money, or even animal life. Attention to the proper care and maintenance of expensive equipment is likewise an important technician responsibility.

Discipline and intellectual honesty are an important part of training, particularly in the clinical laboratory science courses where life may hang in

the balance as an outcome of clinical tests. Students must learn to perform their laboratory work accurately and report the test results honestly. If an experiment or diagnostic procedure does not produce the expected results, students should be encouraged to repeat the procedure until they determine why. Aberrant test results may occasionally be an indication of something dramatically abnormal with a patient's physical condition rather than an error in procedure. The veterinary practitioner and research investigator must receive reports based on facts, not fiction, from their trusted employees.

The basic and beginning technical courses in this curriculum, the other science courses, communications skills and mathematics are included in the first and second semesters. This approach provides an educational balance of technical versus general courses and allows the student to reflect on the relationships which exist between these courses. It also establishes the breadth of base in science and mathematics permitted by the limited time for the curriculum, and it provides adequate foundation for students to probe and study more advanced procedures and techniques during third and fourth semester specialty courses.

This curriculum provides for a substantial amount of time for laboratory work in the various courses. As soon as the underlying theory in a course is developed and understood, it is applied in the laboratory exercises with each succeeding course adding experience in depth. As noted earlier, there is a definite progressive relationship and synchronization built into this curriculum, especially among laboratory-oriented courses. For example, a fundamental knowledge of chemical principles, acquired in the first semester, is necessary for proper understanding and study of normal and abnormal physiology. The third semester Laboratory Techniques course is a study in clinical laboratory diagnostic testing for determining normal and abnormal body function. In the fourth semester course in clinical techniques, students continue to practice and perfect their skills in laboratory testing as an adjunct to monitoring the condition of their surgical and medical patients.

Applied Microbiology is taught the semester immediately following Introductory Microbiology in order to build on and reinforce the basic principles and concepts presented earlier. Application to the field of veterinary science technology is made immediately so that maximum benefit can be gained from associative and correlative aspects of the two courses.

The animal diseases course, programmed in the third semester, becomes, in part, a natural extension of the study in introductory and applied microbiology. A fundamental understanding of material presented in the animal diseases course is essential for application in laboratory animal methods, meat inspection and regulatory technology which follow in the curriculum. Other, similar relationships between basic and advanced courses can be noted.

Courses offered in the fourth semester are highly specialized; hence, the need for designing a separate option for meat inspection and regulatory technology. The facilities required for the optional program in the fourth semester also differ considerably in construction and kind of equipment. In the case of veterinary science technology, the laboratory facilities should be designed to simulate as closely as possible the clinical type of work areas found in animal hospitals and medical research laboratories. The design requirements of the laboratory utilized for demonstrating and illustrating the principles of germfree technology are especially unique and exacting. To provide practical experience for students in the meat inspection and regulatory technology option, a college slaughter and processing laboratory is desirable, as demonstrated in Figure 6. If for some reason it cannot be provided, students should be given the opportunity to participate in demonstrations at commercial packing plants. Field trips to livestock sales exchanges and State-Federal diagnostic laboratories should also be considered.

All courses in this training program through the third semester have a common application in the veterinary-biomedical field. Thus, the optional program, in the fourth semester, may be listed in the college catalog a full year before the extra staff and facilities are provided, and first-year costs will be kept relatively modest.

The middle management function which the technician is expected to perform, particularly in the veterinary hospital or research laboratory, has influenced the inclusion of certain courses. In carrying out instructions of the doctor or research investigator and in supervising subordinate personnel, an adequate understanding of the principles of human relations is essential. In the medical research laboratory, the technician may assist in gathering and reporting numerical data, retrieving information through library research, and/or helping to prepare supporting documents

Figure 6—These students are being instructed in the technique of beef carcass and slaughtering process inspection. Note the specialized equipment and facilities required.

for approval and fiscal support of scientific research projects. The course included in Technical Reporting provides for development of facility in this area. A technician supervisor, responsible for management of a laboratory animal production colony or in handling finances in an animal hospital, is obviously better prepared to perform if he has an understanding of general and industrial economics.

The specialized course in Animal Hospital Procedures has been included in the fourth semester. It establishes a base of professional ethics after which the technician can pattern his conduct when employed. Further, it is designed to provide guidance and capabilities in the non-professional and business managment aspects of veterinary hospital operations. Performing in the capacity of supervisor, client relations officer, and business officer manager, the technician relieves the veterinary medical doctor from many time-consuming tasks for more professional duties of diagnosis and treatment.

Aerospace, cancer, nutritional, and other medical research programs have brought about increasing needs for better quality research laboratory animals. The microbiological, genetic, and physical profiles of these animals must be accurately defined or known and environmental factors during the experiment exactingly controlled. The Laboratory Animal Methods course has been designed and included in the curriculum to provide the technician with proficiencies and capabilities in the latest techniques and procedures practiced in the laboratory animal vivarium and medical research laboratory. The suggested laboratory exercises in germfree technology and rodent endocrinectomies are examples of two important laboratory animal research emphases unique to this curricular option.

Both Animal Hospital Procedures and Laboratory Animal Methods are courses, which as outlined here, are found in few curriculums at the present time, yet appear to be needed as the role of the veterinary technician expands and becomes more generally understood. In fact, in a few institutions where veterinary science technology programs have been in effect for some time, each course represents the beginning of a sequence of courses in each of these two specialty areas.

Employers want technicians who cannot only perform their daily tasks but who are able to communicate in writing and speaking, to calculate percentages and add figures, and are able to get along with those they serve and with whom they associate. General education courses in this curriculum are designed to accomplish this objective.

The Communications Skills course is provided in the first semester to facilitate the student's use of language throughout the entire program. It includes instruction in both writing and speaking. Instructors in technical courses should set increasingly high standards of clarity, grammatical correctness and neatness for student work in reporting. Freedom to report on veterinary science subjects of their own choosing may add interest and extra motivation. Oral reports presented in the Technical Reporting class will reinforce and give practice in developing speaking abilities as outlined during communication skills sessions. The general education requirements vary considerably from state to state. For that reason, the general education content of this curriculum has been designed to meet the *minimum* needs of students enrolled in it.

The course outlines included in this guide are concise and comprehensive, intended as guides rather than as specific plans of instruction to be covered in an inflexible order or sequence. They

represent a judgment on the relative importance of each instructional unit, especially where time estimates are shown for major divisions within each course. It is expected that the principles outlined in these courses will be supplemented with *veterinary science technology* applications wherever applicable. Field trips add greatly to the effectiveness of instruction if they are planned in advance so that the processes observed relate to the unit being studied at the time of the visit. Guest speakers from the field also contribute a wealth of relevant, up-to-date, practical information and are in a position to challenge the class with interesting problem situations with which the technician will be faced upon graduation. Again, planning in advance is essential so that items for discussion are understood and agreed upon by both the instructor and guest speaker.

The program offered here is not intended to make the individual proficient in all of the duties he might be asked to perform, because proficiency in work of a highly specialized nature comes with practice and experience. It is also impossible to forecast the exact requirements or to predict accurately the course needs or rate of change in requirements for veterinary science technology. Employers are generally agreed that recent graduates need at least six months or more of work experience to orient themselves to their responsibilities and role in an organization. In reality, however, the technician graduate is no different in this respect than the recent professional school graduate. It is anticipated that the truly productive technician graduates in veterinary science technology will continue to study throughout their career in an effort to realize their full potential.

COOPERATIVE EDUCATION PLAN

This technology is adaptable to a cooperative work-study arrangement — a plan which offers important advantages to students, to the school, and to employers of technicians. A cooperative education program is a plan for student learning through coordinated study and employment experience. Students alternate periods of attendance at the institution where they receive their technical education with periods of employment in a veterinary hospital, medical research laboratory, pharmaceutical research laboratory, laboratory animal breeder establishment, slaughter and processing plant, or even in a zoological garden. The students' employment constitutes an essential element in the educational process and should be related as closely as possible to some phase of the field of study in which they are engaged.

There is no substitute for the opportunity for students to test their school-learned theory in a work situation; immediately the study becomes more meaningful. Co-op students learn not only the applied essentials of their technology, but also the importance of reliability, cooperation, and judgment as employed workers in their chosen field.

The co-op students' career choice is stimulated and shaped by their work experiences. Should they find satisfaction in their work, they return to the classroom stimulated to learn as much as possible about their future career. However, should they find through their work experience that they are not fitted for a specific area of work, they may decide to change their major field of study when they return to the college. This early decision may prevent them from wasting time and money on a misguided choice of study. It is also beneficial to the college for students to gain this work experience, especially if in the process any should decide to withdraw from college because of disenchangment with this field of study. If these disillusioned students should remain under such frustrating conditions, they would at best probably become marginal graduates and additionally might exert an undesirable influence on other class members.

A variety of successful methods for implementing a cooperative work study program are in effect at different institutions graduating veterinary technicians. Generally speaking, one semester, one quarter, or one summer period has been found sufficient for work study employment in this career field in order to meet the objectives stated earlier. Often one-half of the class undertakes a work study arrangement while the other half remains for formal study. At the end of the specified term of work study the half who worked returned to their formal studies at school, while the other half are employed. This procedure may or may not be repeated once more during the student's two years at college. Each initiating institution will have to decide for itself which work study plan will best fit its peculiar needs. It should be noted that the student's technical program is lengthened beyond the curriculum outlined in this guide by an amount of time equal to the total length of the employment experience.

Specific employment is obtained, as circumstances permit, by the educational institution,

with the cooperation of the student. The institution regards the work-experience program as an integral part of the technician education program as a whole. Therefore, in most instances a satisfactory overall co-op student performance rating is required in order for the student to continue into the second year of the program. The work-experience program is not regarded primarily as an earning opportunity, although all students are paid at the prevailing wage scale for the job they hold. Work reports by both the student and the employer are submitted to the school work-program coordinator. The college should provide an opportunity for the work-program coordinator to visit with each student/employer at least once during the work-experience period.

As mentioned earlier, the cooperative work-experience program is an opportunity to gain directly related experience which will make the student more desirable as an employee. As a result of their work-experience with a particular establishment, many students have been offered permanent positions with that organization upon completion of their schooling. Cooperating establishments agree, however, not to make offers of employment which become effective before the completion of the technician's educational program.

Cooperative programs provide special opportunities for the educational institution to maintain close contact with employers in their various programs. This contact becomes a valuable two-way channel of communication which helps the educational institution to keep its knowledge of specific employer needs in each technical field up to date, and at the same time keeps employers acquainted with and involved in the program of the institution.

SUGGESTED CONTINUING STUDY

A two-year technical training program concentrates on the primary needs, related knowledge and complementary skills as perceived to be important to the industry served. With the limited amount of time available to it, a program of this nature cannot provide instructional depth in all the subjects which are pertinent to a particular technology. In addition, it is impossible to predict changes that may arise due to our changing economy and technology. Some form of continuing study for graduates of technology programs therefore seems very desirable.

In the field of veterinary science technology, continuing education for those that are interested may be achieved in a variety of different ways. The simplest method, of course, is through reading current literature related to the technology. This approach helps the graduate keep abreast of technical developments in his field of specialization. The method is limited in value, however, since it tends only to build on the organized technological base provided by the curriculum that was originally studied.

The next most favorable approach is probably attendance in seminar or workshop type sessions. These programs are usually sponsored periodically by or in cooperation with the State Veterinary Medical Society (at their annual business meeting), the regional or local branches of the American Association for Laboratory Animal Science (quarterly or annually), and at annual veterinary college conferences. These programs consist of a number of one-half hour to one hour lectures on different subjects in an attempt to provide something relevant and of interest to everyone in attendance. The workshop type program provides more opportunity for actual participation in the subject discussion.

Formal continuation in supplementary courses, no doubt, provides the most efficient and practical means of adding important related areas of knowledge and skill to the initial education of the two-year technical program graduate. These courses offer the advantages of systematic subject coverage, disciplined and competent teaching, opportunity for class discussion, and scheduling on evening or Saturday hours which does not conflict with the technician's working day. Again, there are various kinds of formal courses to choose from: there are available summer short courses in schools of veterinary science technology, in-service-training programs where the employing institution can afford it and has the instructional capability, and the classical evening or extension courses offered by almost all accredited colleges and universities.

The summer short courses are usually of one or two weeks duration and designed as "refresher" courses or intensive introductory courses in specialized subject areas such as hematology, radiological techniques, laboratory animal anatomy, advanced laboratory animal techniques, etc. The group shown in Figure 7 represents a class of students gathered to participate in a continuing education program (summer "refresher" course).

Figure 7 — This group of technicians from veterinary medical practices and biomedical research laboratories have assembled for a "refresher" course in hematology. Note the specialized facilities and equipment required for such a continuing education program.

The in-service-training programs are usually structured once or twice weekly for one or two hours per session for a number of weeks or months. They are designed to provide information and demonstrate techniques and methods of operation which will allow upgrading of employee capabilities, thus making participants more valuable to the institution or company. One example of the type of educational program frequently sponsored for technicians is that dealing with human relations and principles of supervision. Veterinary medical centers, university medical centers (human) and the large pharmaceutical houses are most often involved in this kind of continuing education for technicians.

In the area of college evening or extension courses, there is a wide range of continuing educational courses open to the technician. All that is required of an individual is an interest in the subject matter, ambition and willingness to sacrifice evening hours (after a day of labor), and payment of a nominal course fee. In certain university or commercial company employment situations, it is becoming fairly common for the employer to share or pay all the cost of tuition for continuing education courses, if they relate to the job the technician is performing. Where technicians are employed in colleges, hospitals, or universities, opportunities for enrollment in related courses such as biology, microbiology, medical technology or biochemistry should not be overlooked, if these are available in their parent or affiliated institutions. Technicians with persistence may even earn the baccalaureate degree after a period of time.

The following are examples of courses which might be considered for continuing study by veterinary science technology graduates who want to improve and expand their usefulness on the job.

Advanced genetics
Data processing
Environmental science
Exotic animal management
Federal, State, and local taxes
Histological techniques
Principles of accounting
Principles of business management
Psychology
Sociology
Typing
Veterinary and biomedical instrumentation
Zoology

COURSE OUTLINES

The course outlines which follow are suggested to provide the content which should be taught in the curriculum. The materials suggested provide a practical and attainable coverage of the field and have been reviewed by experienced instructors in successful veterinary science technical education programs and by experts representing employers of these technical graduates.

Some modification of content may be acceptable to meet the needs defined by local advisory committees and to use effectively the special interests and capabilities of teaching staffs. However, the implied level, quality, and completeness of the program should not be compromised.

At the end of each course outline is a list of texts and references. Each should be analyzed for its content and pertinency; current editions should be substituted, and new books relevant to the subject matter added, as soon as they are available. Total information desired for courses in veterinary science technology curriculums, particularly the technical specialty courses, is seldom available in one textbook, hence several are suggested in the list. Considerable augmentation of the lists is possible with current materials from manufacturers, trade and professional journals, pamphlets and newsletters of technical societies, and informational brochures from suppliers of apparatus and services in the option studied.

A list of suggested instructional media is also offered for most of the courses. A visual aid should be used when it is appropriate, and when its use serves as an effective teaching method. Films and filmstrips which are current and of good teaching quality are sparsely available for application in the field of veterinary science technology today. (There is a great need for development of this type of instructional medium in all subject areas of this curriculum.) *Instructors should avoid the excessive use of films to replace well prepared lectures and demonstrations.* All visual aids should be examined by the instructor prior to their being shown to the class.

Undoubtedly, the experienced instructor will make liberal use of charts, slides, models, samples and specimens to illustrate special technical aspects of the subject. These instructional aids are usually accumulated by the instructor from the experience of previous laboratory or lecture preparations, and should be updated when new developments occur. Since this type of material belongs in private collections, it is not generally available for distribution to others. However, it is helpful to realize that assistance in this area is about to appear on the horizon. As noted previously, this help will appear in the form of *teaching modules* to be produced by Project BIOTECH, under the auspices of the American Institute of Biological Sciences, 3900 Wisconsin Avenue, N.W., Washington, D. C. 20016. It is anticipated that within three years this organization will have produced 300-400 modules, almost all of which will be appropriate for use in two-year veterinary science technology training programs. A teaching module is defined as "a kit of teaching materials available to the user as a single unit, covering only one task (concept)". When these become available, they are to be nationally advertised and distributed.

The laboratory hours suggested in the curriculum outlines and course descriptions are not necessarily intended to be achieved in single sessions. They represent total hours of laboratory per week, to be scheduled in reasonable and effective increments. For example, a six-hour laboratory total per week, might be scheduled as three two-hour sessions, two three-hour sessions per week, or any other divisions that seem appropriate.

ANIMAL DISEASES

Hours Per Week
Class, 3

Course Description

A course which introduces the student to the concept of disease and the pathological state. Having just previously completed the course in comparative anatomy and physiology, the student progresses to an understanding of how disease is produced in the animal body. The major types of diseases are classified and examples of specific diseases which relate to each type are outlined.

A substantial portion of the study is devoted to the infectious and zoonotic diseases. In reference to the zoonoses, the epidemiological characteristics, causative agent, symptoms, pathogenicity and recommended control for each disease are covered. Public health implications are presented for the zoonoses affecting laboratory animals as well as domestic large and small animals.

Emphasis is placed on the student recognizing and identifying lesions, which may represent some disease process, rather than to attempt actual diagnosis of the specific disease. In this respect, the student is made ready for instruction in necropsy and inspection techniques found in fourth semester technical courses. Likewise, this course will develop an appreciation for the importance of good colony and herd management, proper sanitation practices and the latest methods of disease control and prevention.

Major Divisions

	Class Hours
I. Introduction to Disease	1
II. Etiology	2
III. Congential Diseases	3
IV. Acquired Diseases	6
V. Retrogressive Disease Processes	3
VI. Reactive Disease Processes	4
VII. Microbic Diseases (Non-Zoonotic)	10
VIII. Zoonoses	17
IX. Behavioral Diseases	2
Total	48

Units of Instruction

I. Introduction to Disease
- A. Health
  - 1. Definitions
  - 2. Individual and population
- B. Disease
  - 1. Definitions
  - 2. Form, substance, function
  - 3. Virchow — theory of disease
  - 4. Structural levels of disease

II. Etiology
- A. Evolution and lesions
- B. Casual agents
  - 1. Causality
  - 2. Necessary conditions
  - 3. Predisposing or contributing factors

III. Congential Diseases
- A. Hereditary diseases
- B. Inherited predisposition
- C. Pre-natal infection
- D. Developmental diseases

IV. Acquired Diseases
- A. Nutritional diseases
- B. Overwork or overstrain
- C. Trauma
- D. Physical agents
- E. Micro-organisms
- F. Parasites
- G. Chemical agents

V. Retrogressive Disease Processes
- A. Degenerative
  - 1. Cloudy swelling
  - 2. Fatty degeneration
- B. Infiltration
  - 1. Fatty infiltration
  - 2. Calcareous infiltration
- C. Tumors
  - 1. Benign
  - 2. Malignant

VI. Reactive Disease Processes
- A. Inflammation
  - 1. Acute
  - 2. Chronic
- B. Repair
  - 1. First intention
  - 2. Second intention
- C. Fever
  - 1. Causes of fever

2. Changes occurring during fever

VII. Microbic Diseases (Non-Zoonotic)
- A. Neurotropic virus diseases
  1. Poliomyelitis of mice
  2. Scrapie of sheep
- B. Epitheliotropic virus diseases
  1. Foot and mouth disease
  2. Mouse pox
- C. Pneumotropic virus diseases
  1. Swine influenza
  2. Chronic murine pneumonia
  3. Feline pneumonitis
  4. Infectious bovine rhino-tracheitis
- D. Pantropic virus diseases
  1. Canine distemper
  2. Hog cholera
  3. Equine infectious anemia
  4. Feline panleucopenia
  5. Epidemic diarrhea of infant mice
- E. Tumor causing virus diseases
  1. Papillomatosis
  2. Avian leukosis
  3. Bittner's mammary-tumor milk agent
  4. Shope fibroma and myxomatosis
  5. Bovine lymphomatosis
- F. Diseases due to true bacteria (Eubacteriales)
  1. Blackleg
  2. Malignant edema
  3. Enterotoxemia
  4. Strangles
  5. Mastitis
  6. Glanders
  7. Hemorrhagic septicemias
  8. Listeriosis
- G. Diseases due to higher bacteria
  1. Paratuberculosis
  2. Infections due to corynebacterium
  3. Rabbit syphilis

VIII. Zoonoses
- A. Definitions and concepts
- B. Neurotropic virus zoonoses
  1. Rabies
  2. Equine encephalitis
  3. Lymphocytic choriomeningitis
  4. B virus infection
- C. Epitheliotrophic virus zoonoses
  1. Vesicular stomatitis
  2. Contagious ovine ecthyma
  3. Cat scratch fever
  4. Cow pox
- D. Pantropic virus zoonoses
  1. Rift valley fever
  2. Influenza
  3. Newcastle disease
- E. Rickettsial zoonoses
  1. Psittacosis
  2. Q fever
  3. Typhus
- F. Zoonoses due to true bacteria
  1. Plague
  2. Tularemia
  3. Brucellosis
  4. Salmonellosis
  5. Erysipeloid
  6. Anthrax
  7. Haverhill fever
- G. Zoonoses due to higher bacteria
  1. Sodoku
  2. Weil's disease
  3. Canicola fever
  4. Tuberculosis
- H. Zoonoses due to fungi
  1. Dermatophytoses
  2. Coccidioidomycosis
  3. Histoplasmosis
  4. Blastomycosis
  5. Cryptococcosis
  6. Moniliasis

IX. Behavorial Diseases
- A. Confused sexual roles
- B. Whisker and fur chewing
- C. Cannibalism

Texts and References

Coles. *Veterinary Clinical Pathology.*
Faust and others. *Animal Agents and Vectors of Human Disease.*
Gordon. *Control of Communicable Diseases in Man.*
Minckler and others. *Pathobiology.*
Ribelin and McCoy. *Pathology of Laboratory Animals.*
Runnells and others. *Principles of Veterinary Pathology.*
Smith and Jones. *Veterinary Pathology.*
Van der Hoeden. *Zoonoses.*

Instructional Media

Alden Films (McGraw Hill), 5113 16th Avenue, Brooklyn, New York 11200
Stress. 11 min., 16 mm., black and white, sound.

American Society of Microbiology, 115 Huron View Boulevard, Ann Arbor, Michigan
Rabies. 7 min., 16 mm., black and white, silent.

American Veterinary Medical Association, Film Library, 600 South Michigan Avenue, Chicago, Illinois 60605
Anthrax in Ohio. 25 min., 16 mm., color, sound.
Epidemic Foot and Mouth Disease — Saskatchewan. 16 min., 16 mm., color, sound.
Epidemiology of Salmonellosis in Man and Animals. 14 min., 16 mm., color, sound.

Leptospirosis and the Veterinarian. 12 min., 16 mm., color, sound.

Association Films, Inc., Schering Professional Film Library, Broad and Elm, Ridgefield, New Jersey 07657

Diagnosis and Management of Fungus Infections of the Skin, Hair and Nails. 30 min., 16 mm., color, sound.

Cornell University, Department of Communication Arts, College of Agriculture, Ithaca, New York 14850

Back the Attack on Bruccellosis. 27-1/2 min., 16 mm., color, sound.

Radiation Effects on Farm Animals. 13 min., 16 mm., color, sound.

Skin Diseases in Animals. 25 min., 16 mm., color, sound.

Encyclopedia Britannica Educational Corporation, 188 Pickwick Avenue, Glenview, Illinois 60025

Body Defenses Against Disease. 11 min., 16 mm., black and white, sound.

Lederle Laboratories, Film Library, American Cynamid Company, Pearl River, New York 10965

The Inflammatory Reaction. 26 min., 16 mm., color, sound.

National Medical Audio Visual Center (Annex), Chamblee, Georgia 20005 (Attention: Film Distribution)

Epidemiology of Brucellosis. Film Strip, 86 frames, 35 mm., color, sound.

Plague in Sylvatic Areas. 26 min., 16 mm., color, sound.

ANIMAL HOSPITAL PROCEDURES

Hours Per Week
Class, 3

Course Description

A course designed to outline and establish the necessary attitudes, understanding and skills for effective performance when employed as a paraprofessional in an animal hospital. Orientation will focus upon areas of technician responsibility in hospital business operations and management. Methods for relieving the doctor of the more routine hospital duties in favor of professional functions, will be pursued.

To provide interesting, relevant, and up-to-date practice and business methods orientation, considerable use is made of guest speakers from the field. Personnel who are called upon for assistance in this area include: (1) outstanding veterinary practitioners, (2) supervising veterinary technicians from practice, (3) a representative from a veterinary college, veterinary student chapter, or animal medical center, (4) sales representatives from veterinary drug companies, (5) a public relations representative of the regional telephone company, and (6) others as time allows. Students are encouraged to ask questions and further investigate the topics presented by guest speakers.

To effectively illustrate principles and concepts presented in lecture material, maximum use is made of audio-visual aids. Additionally, certain portions of the course will rely heavily upon problem solving as a technique for developing understanding and facility in these practicular areas.

Major Divisions

	Class Hours
I. Overview of Course and Orientation to the Technician's Role in a Veterinary Practice	2
II. Orientation to the Profession of Veterinary Medicine	3
III. Principles of Veterinary Medical, Office, and Personal Ethics	4
IV. The Veterinary Technician, His Identity, and Jurisprudence	3
V. The Image Builder (Receptionist) and Client Relations	3
VI. Duties of the Office Secretary	3
VII. Hospital Records and Business Transactions	7
VIII. Clinical Pharmacology and Pharmacy Operation	12
IX. Veterinary Medical Nursing	7
X. Small Animal Grooming Techniques	2
XI. Human Relations and the Supervising Technician	2
Total	48

Units of Instruction

I. Overview of Course and Orientation to the Technician's Role in the Veterinary Practice
- A. Philosophy of veterinary technician training and utilization in practice
- B. Survey of class members regarding practice experience
- C. Outline of work areas and responsibilities usually delegated to the technician in a veterinary practice

II. Orientation to the Profession of Veterinary Medicine
- A. History
- B. Present statistical breakdown of professional service areas
- C. Education of veterinarians
- D. Veterinary organizations
- E. A.V.M.A. — the national professional organization
  1. Composition and make-up of governing bodies
  2. A.V.M.A. councils
     - a. Judicial
     - b. Education
     - c. Research
     - d. Veterinary service
     - e. Biological and therapeutic agents
     - f. Public health
  3. Special interest groups
  4. Specialty boards
  5. The A.V.M.A. professional staff
     - a. Headquarters
     - b. Staffing
     - c. Functions
  6. A.V.M.A. publications
  7. Types of memberships in A.V.M.A.

III. Principles of Veterinary Medical, Office, and Personal Ethics
- A. The code of veterinary medical ethics
  1. Sponsored by

2. Purpose
3. Enforcement
4. Applications for the veterinary technician
5. Section I — General conduct
   a. Department
   b. Frauds
   c. Commercialism
   d. Deceptive surgery
6. Section II — Communication with the public
   a. Advertising
   b. Telephone directories
   c. Professional stationery
   d. Professional signs
   e. Emergency service
   f. Identification tags
   g. Animal shows
   h. Vehicular advertising
   i. Greeting cards and calendars
   j. Reminder cards
   k. Fees for services rendered
   l. Liaison with dog pounds, humane societies, farm cooperatives
   m. Definitions of veterinary facilities
      (1) Animal medical center
      (2) Animal clinic
      (3) Animal hospital
7. Section III — Employment of professional knowledge
   a. Alliance with unqualified persons
   b. Testimonials and endorsements
   c. Boarding kennels, pet shops and pharmacies
   d. Merchandizing vs. dispensing
8. Section IV — Enhancing the quality of veterinary services through consultations and cooperation
9. Section V — Professional self-discipline
10. Section VI — Responsibilities of the professional to society as well as to the patient
11. Reviewing of the meaning and application of the "Code" to the technician

B. Office ethics
   1. Definition
   2. Purpose
   3. Conduct

C. Personal ethics
   1. Definition
   2. Conduct
      a. Accuracy
      b. Cooperation
      c. Dependability
      d. Personal initiative
      e. Loyalty
      f. Building rapport
      g. Leaving an employment position

IV. The Veterinary Technician, His Identity, and Jurisprudence
   A. Institutions training veterinary science technicians
   B. Alumni organization
   C. Relationship to other lay assistants
   D. Legal status of technicians
      1. Accreditation of training programs
      2. Certification
         a. Veterinary medical practice acts
         b. Veterinary medical examining boards
         c. Board exams
         d. Certification vs. licensure
      3. Veterinary medical jurisprudence

V. The Image Builder (Receptionist) and Client Relations
   A. Importance of receptionist's "image"
   B. Psychology of client relations
      1. General considerations
      2. Client orientation
      3. Communication with clients
      4. Reception of clients
         a. General considerations
         b. Opening the office
         c. Problem clients
         d. Making appointments
   C. Information for clients
   D. Hospital work slip
   E. Discharging patients/clients
      1. Patients condition at discharge
      2. Instructions to owner
      3. Collecting fees due
      4. Suggesting other services
      5. Encouraging clients return

VI. Duties of the Office Secretary
   A. Office mail and correspondence
   B. Keeping historical records
      1. Daily log or appointment book
      2. Completing and filing case histories, etc.
         a. Current patient/client files
         b. Patient/client "dead" files
         c. Correspondence
            (1) Filing system
            (2) Cross referencing
      3. Ownership of patient/client records
      4. Confidentiality of client records
   C. Telephone techniques
      1. The audio "image"
      2. Voice qualities that are desirable

3. Telephone courtesy
4. Answering incoming calls
5. Special considerations regarding house or farm call appointments
   a. Information needed
   b. Emergency calls
   c. Instructions for doctor on arrival
6. "Island of communication"
7. Quick reference list of most frequently used telephone numbers
8. Telephone answering services
   a. Personal type
   b. Automatic recording systems
9. Two-way radio operation

VII. Hospital Records and Business Transactions
- A. Purpose for keeping accurate, concise financial and business operation records
- B. Types of business records and summaries kept
  1. Individual client financial record
  2. Daily earnings record
  3. Monthly earnings summary
  4. Yearly earnings summary
  5. Income other than from practice
  6. Deductible disbursement other than for practice
  7. Monthly practice disbursements
  8. Yearly disbursement summary
  9. Asset depreciation record
  10. Yearly depreciation summary
  11. Individual payroll record
  12. Payroll summary record
  13. Checking account operation
- C. Income tax record and Social Security
  1. Reporting taxes and wages
     a. Cash method
     b. Accrual method
  2. Forms required
  3. Exemptions from paying Social Security taxes
- D. Workmen's Compensation
- E. Class exercise utilizing "Histacount" system (or some double-entry system)
- F. Handling cash
- G. Inventory records
- H. Billings and collections

VIII. Clinical Pharmacology and Pharmacy Operation
- A. Definitions and terminology relating to drug handling
  1. Pharmacology
  2. Pharmacologist
  3. Pharmacist
  4. Other
- B. Types of veterinary drug suppliers
- C. Veterinary drug catalogue breakdowns
- D. Biological products
  1. Definition
  2. Examples
     a. Live organisms
     b. Killed organisms
     c. Inactivated toxins (toxoid)
     d. Antitoxins
     e. Antibodies
     f. Miscellaneous biologicals
  3. Methods of vaccine production
  4. Packaging and handling biologicals
- E. Pharmaceuticals
  1. Definition
  2. Brand name vs. generic name
  3. Packaging of pharmaceuticals
- F. Antibiotics
- G. Chemotherapeutic agents
- H. Drug ordering
- I. Purchasing discounts
  1. Quantity
  2. Cash
  3. Prepaid transportation
- J. Return of merchandise
- K. Damaged shipments
- L. Drug inventories
  1. Spot checks
  2. Perpetual or daily
  3. Year-end
- M. Understanding and filling prescriptions
  1. Definition of Rx
  2. Essential parts of a classical prescription
  3. Commonly used Rx abbreviations
  4. Weights and measures
     a. Metric
     b. Apothecaries
     c. Conversion equivalents
  5. Practice solving problems involving Rx writing and drug dispensing
- N. Drug administration
  1. General factors producing variable response
  2. Methods of drug administration
     a. Oral
        (1) Advantages and disadvantages
        (2) Restraint and methods of administration of different oral dosage forms
        (3) Gastric lavage
     b. Parenteral

(1) Equipment needed
(2) Aseptic technique and preparation of parenteral medications for injection
(3) Dangers involved with parenteral injections
(4) Minimizing pain on injection
(5) Parenteral injection sites
(6) Terminology related to drug administration

O. Study of drugs according to clinical usage
1. Sources of drugs
2. Drug dosage forms
3. Principles of drug activity
a. Types of drug action
b. Distribution and concentration in tissues
c. Drug metabolism
d. Quantitative dose effect
e. Drug combinations
f. Drug compatabilities
g. Drug antagonism
h. Drug synergism
4. Drugs affecting the central nervous system
5. Drugs affecting the autonomic nervous system
6. Muscle relaxants
7. Local anesthetics
8. Cardiotonic drugs and diuretics
9. Blood coagulants
10. Antianemic drugs
11. Drugs affecting metabolism
12. Hormones
13. Anti-infective drugs
14. Parasiticides
15. Symptomatic medicaments

P. Pharmacy management
1. Dispensing procedures
2. Ordering, receiving, and handling drugs
3. Rapport with drug salesmen
4. Inventory of drugs
5. Special considerations for narcotic, stimulant and depressant drugs
a. The law and regulations
b. Ordering requirements
(1) BNDD number
(2) Special order forms
(3) Annual reports
c. Security of: narcotic, stimulant, and depressant drugs; injection needles; syringes
d. Inventories required

IX. Veterinary Medical Nursing
A. Care of sick animals
B. Restraint techniques
C. First aid
D. Technique of medication
E. Signs of disease
F. Diseases commonly diagnosed and treated in the animal hospital
G. Vaccination programs for the common infectious and/or contagious diseases

X. Small Animal Grooming Techniques
A. Breeds most often involved
B. Reasons for grooming
1. Professional show
2. Therapeutic
C. Equipment required
1. Clippers (blade types)
2. Combs, brushes, scissors
3. Slings and tables
D. Maintenance of equipment
E. Types of clips
F. Technique of clipping
G. Bathing
H. Parasiticidal dips
I. Dental prophylaxis

XI. Human Relations and the Supervising Technician
A. Characteristics and the role of a good supervisor
B. Interviewing new personnel
C. Evaluation of job performance
D. Counseling and appeal
E. Releasing personnel from employment (firing)
F. Training of personnel
G. Motivation
H. Some do's and don't's

Texts and References

American Telephone and Telegraph Company. *Win More Friends by Telephone.*
American Veterinary Medical Association. *Principles of Veterinary Medical Ethics.*
Catcott. *Animal Hospital Technology: A Text for Veterinary Aides.*
Federal Register. *Regulations Implementing the Comprehensive Drug Abuse Prevention and Control Act of 1970.*
Grey. *Veterinarians' Product and Therapeutic Reference.*
Histacount Corporation. *Histacount Key Master Bookkeeping System — Veterinarian's Edition.*
Jones. *Veterinary Pharmacology and Therapeutics.*
Kirk. *Current Veterinary Therapy.*
Kirk and Bistner. *Handbook of Veterinary Procedures and Emergency Treatment.*

Lawton and Foy. *Comprehensive Review for the Medical Assistant.*
———. *A Textbook for Medical Assistants.*
Leahy. *Restraint of Animals.*
New York State Department of Health. *Article 33-A Public Health Law (Depressent and Stimulant Drug Control Act).*
Peterson. *The Dentist and His Assistant.*
Pfizer and Company, Inc. *Modern Concepts of Veterinary Client Service.*
Sarner. *The Business Management of a Small Animal Practice.*
Squire. *Basic Pharmacology for Nurses.*

Instructional Media

Association Films, Inc., Schering Professional Film Library, Broad at Elm, Ridgefield, New Jersey 07657
Consultant to Twenty Million. 13 min., 16 mm., color, sound.
Prescription Writing in Modern Dentistry. 25 min., 16 mm., color, sound.

Cornell University, Film Library, Department of Communication Arts, Ithaca, New York 14850
Friend of a Friend. 15 min., 16 mm., black and white, sound.

Eli Lilly and Company, Audio-Visual Film Library, P.O. Box 618, Indianapolis, Indiana 46206
Bridge to Tomorrow. 26 min., 16 mm., color, sound.
What It Takes Is Time. 20 min., 16 mm., color, sound.
Your Clients Want to Know. 20 min., 16 mm., color, sound.

New York Telephone Company, Film Library, 1750 Genesee Street, Utica, New York 13502
A Manner of Speaking. 28 min., 16 mm., color, sound.
For Immediate Action. 18 min., 16 mm., color sound.
The Voice of Your Business. 12-1/2 min., 16 mm., color, sound.

State University of New York at Delhi, Audio-Visual Department, Delhi, New York 13753
Preparation for Aseptic Surgery. 30 min., 1 inch Ampex Video Tape, black and white, sound.
Small Animal Restraint. 20 min., 1 inch Ampex Video Tape, black and white, sound.

Sterling Movies, Inc., 43 West 61st Street, New York, New York 10023
Medicine Man. 27 min., 16 mm., black and white, sound.
I Am a Doctor. 30 min., 16 mm., color, sound.

ANIMAL MANAGEMENT

Hours Per Week

Class, 4; Laboratory, 6.

Course Description

Basic principles of animal management are studied through exploring the areas of husbandry, breeds and strains, social and reproductive behavior, feeding methods and animal housing. Techniques of restraint, handling, identification, care, clinical observation and knowledge of commercial and industrial usage of various species are acquired during laboratory sessions.

Laboratory practice in necropsy technique is gained through the use of available clinical cases and small laboratory animals. Methods for establishing breeding programs and production schedules, acquisition quarantine and conditioning requirements necessary for optimum performance of the various species will be developed.

Each of the subjects will be presented within the context of comparing and contrasting the needs of the companion, laboratory, and food producing animals.

Major Divisions

	Class Hours
I. Breeds and Strains of Animals	6
II. Animal Behavior	12
III. Restraint and Handling	4
IV. Care and Housing	6
V. Feeding Methods	4
VI. Animal Identification and Records	4
VII. Acquisition of New Animals	4
VIII. Production Schedules	5
IX. Breeding Programs	5
X. Maintaining Colony or Herd Health	14
Total	64

Units of Instruction

I. Breeds and Strains of Animals
- A. Horse
  1. Riding
  2. Working
- B. Bovine
  1. Beef
  2. Dairy
- C. Sheep
  1. Wool
  2. Meat
- D. Swine
  1. Lard type
  2. Bacon type
- E. Dog
  1. Working
  2. Companion
- F. Rabbit
  1. Fur
  2. Meat
- G. Mouse
  1. Tumor studies
  2. Virus studies
  3. Bio-assay type
- H. Exotics
  1. Primate
  2. Research
  3. Exotic companion
- I. Feline

II. Animal Behavior
- A. Introduction
- B. Behavior patterns
  1. Causes
  2. Daily and seasonal cycles
  3. Physiologic basis
  4. Environmental modification
  5. Developmental changes
- C. Motivations
  1. Hunger
  2. Thirst
  3. Sex
  4. Pain
  5. Elimination
- D. Methods of communication
  1. Sound
  2. Olfactory
  3. Visual
- E. Social relationships
  1. Care dependency
  2. Dominance and subordination
  3. Sexual relationships
  4. Leader-follower relationships
  5. Inter-species relationships
  6. Socialization
  7. The role of man as a part of the herd or colony
- F. Population density and behavior
  1. Social pathology
  2. Litter size
  3. Birth rate
  4. Cannibalism
  5. Suicide

G. Effects of environment on behavior
   1. Heat
   2. Cold
   3. Odors
   4. Noise
   5. Light
   6. Nutrition

III. Restraint and Handling
   A. Principles
   B. Applications
      1. Horse
      2. Cow
      3. Sheep
      4. Swine
      5. Dog
      6. Cat
      7. Rabbit
      8. Guinea pig
      9. Mouse
      10. Rat
      11. Birds

IV. Care and Housing
   A. Purpose of housing and climate control
   B. Farm animals
      1. Housing requirements for horses, dairy cattle, beef cattle, swine and sheep
      2. Housing requirements for laboratory rabbits, dogs, rodents, primates
      3. Housing requirements for fowl
   C. Sanitation
      1. Waste removal
      2. Disinfection
      3. Arthropod and insect control

V. Feeding Methods
   A. Starting animals on feed
      1. Individual species requirements
      2. Amount, frequence, regularity and order of feeding
   B. Hand feeding versus self-feeding
   C. Feed preparation
      1. Grinding or rolling
      2. Pelleting
      3. Cooking
      4. Cutting or grinding
      5. Feed supplements
   D. Commercial feeds
      1. Selection criteria
      2. Ingredients indicated on feed tag
   E. Species requirements for feed containers
   F. Water requirements
      1. Containers
      2. Automatic waterers

VI. Animal Identification and Records
   A. General principles
   B. Identification methods
      1. Individual characteristics
      2. Ear tagging
      3. Ear punching
      4. Tattooing
      5. Toe clipping
      6. Leg banding
      7. Neck chain numbering
      8. Collar tag
      9. Branding
   C. Records
      1. Animal procurement records
      2. Quarantine colony records
      3. Test data records
      4. Production data records
      5. Reproductive records
      6. Animal health records
      7. Financial records

VII. Acquisition of New Animals
   A. Criteria and specifications
      1. Species
      2. Strains
      3. Sex
      4. Numbers
      5. Body weight
      6. Stage of maturity
      7. Pre-shipping treatment
      8. Surgical pre-treatment
      9. Delivery date
      10. Delivery site
      11. Mode of transportation
      12. Payment
      13. Single or standing order
   B. Receiving procedures
      1. Isolation
      2. Quarantine
      3. Vaccination program
      4. Deworming
      5. Clinical examination
      6. Health certificates
      7. Hematologic and biochemical profiles
      8. Special conditioning
   C. Introduction of newly acquired stock into main animal colony or herd

VIII. Production Schedules
   A. Market fluctuations
      1. Species specific influences
      2. Time scheduling to allow for consideration of:
         a. Weight gain
         b. Litter size

c. Weight at weaning
d. Time between birth and weaning
e. Gestation period
f. Frequency of estrus
g. Expected mortality and morbidity rates
h. Infertility rates

IX. Breeding Programs
A. Natural
B. Artificial
C. Intensive breeding
1. Monogamous
2. Bigamous
3. Polygamous
D. Seasonal variation
E. Breeder replacement
F. Ascertaining of estrus and breeding
1. Vaginal cytology
2. Behavioral observation
3. Anatomical change
4. Cervical mucous discharge

X. Maintaining Colony or Herd Health
A. Providing for professional care
B. Prevention of disease
1. Vaccination
2. Disinfestations
3. Disinfections
4. Culling
5. Personal hygiene
6. Avoidance of undesirable inherited characteristics
7. Poison control
8. Observation and recognition of abnormalities

Suggested Laboratory Projects (96 hours)

1. Familiarization with breeds and strains. A field trip to livestock auction, state or county fair, or college farm. (3 hours)
2. Familiarization with breeds and strains of laboratory animals implemented by a field trip to a research institution or pharmaceutical company . (3 hours)
3. Experience in animal behavior by observing and recording behavior patterns in several laboratory animal species. (3 hours)
4. Experience in animal behavior by observing and recording animal behavior patterns in farm animal species. (3 hours)
5. Practice in restraint of mice, rats, gerbils, and hamsters. (3 hours)
6. Practice in restraint of rabbits, cats, dogs. (3 hours)
7. Practice in restraint of sheep, goats, and pigs. (3 hours)
8. Practice in restraint of cows and horses. (3 hours)
9. To reinforce lecture material on care and housing; define care and housing for one laboratory animal species in terms of biotic, climatic, nutritive, spatial, and temporal fractories of the ecosystem. (3 hours)
10. Same as above for farm animal species. (3 hours)
11. Same as above except for avian species. (3 hours)
12. Observe methods of feed preparation by a field trip to a commercial feed producer. (3 hours)
13. Student participation in methods of identification. Practice ear punching, tattooing, toe clipping, and collar tagging. (3 hours)
14. Student participation in methods of identification. Practice individual characteristics recognition, leg banding, neck chain numbering, branding, and ear tagging. (3 hours)
15. Practice record keeping. Student participation and discussion of various systems of animal production and breeding records including computer analysis. (3 hours)
16. Practice in keeping financial records. Discussion with a Certified Public Accountant on organization of financial records. (3 hours)
17. Exercise in purchasing livestock. Student role-playing in purchase of livestock evolving a definition of the project, criteria of livestock, preparation of purchase order, and consideration for financing. (3 hours)
18. Same as above but for laboratory animals. (3 hours)
19. Practicing receiving procedures. Student participation in shipping, receipt, isolation, clinical examination and vaccination of new animals. (3 hours)
20. Exercise in production and weight gain scheduling. Student participation in the development of a profitable production schedule from given data. (3 hours)
21. Exercise in breeding scheduling. Student participation in developing a breeding program for laboratory animals from given data. (3 hours)
22. Exercise in determing estrus. Study of vaginal cytology in determing stage of estrus. (3 hours)
23. Practice in sanitation techniques. Student participation and familiarization with various methods of sanitation with reference to laboratory species and farm animals. (3 hours)
24. Exercise in culling procedures. Culling and

euthanasia procedures as applied to various species. (3 hours)

25. Student familiarization with various poison control procedures and identification of poisonous plants. (3 hours)
26. Field trip to zoological garden for observation of exotic species to demonstrate housing and behavior. (3 hours)
27. Exposure to legal aspects of buying and selling animals. Student role-playing in simulated litigation involving the laws of implied warranty and the laws of contract. (3 hours)
28. Student observation and recognition of signs of ill health. (3 hours)
29. Monitoring temperatures, pulses and respiratory rates on various species. (3 hours)
30. Anatomy review and observation of disease processes, necropsy procedures including necropsy reports involving various species as available. (6 hours)
31. Skin scraping techniques. (1 hour) Mastitis specimen collection . (2 hours)

Texts and References

Acker. *Animal Science and Industry.*
Blood and Henderson. *Veterinary Medicine.*
Conalty. *Husbandry of Laboratory Animals.*
Hafez. *The Behavior of Domestic Animals.*
Leahy and Barrow. *Restraint of Animals.*
Tinbergen. *Animal Behavior.*
Worden and Lane-Peter. *The UFAW Handbook on the Care and Management of Laboratory Animals.*

Instructional Media

New York State Department of Health, Office of Public Health Education, Film Library Supervisor, 84 Holland Avenue, Albany, New York 12208

Biology and Control of Domestic Flies. 15 min., 16 mm., color, sound.

Sanitary Storage and Collection of Refuse. 19 min., 16 mm., color, sound.

The Water Around Us. 25 min., 16 mm., black and white, sound.

Syracuse University, Film Rental Center, 1455 East Colvin Street, Syracuse, New York 13210

Behavior Theory in Practice Part I. 20 min., 16 mm., color, sound.

Behavior Theory in Practice Part II. 20 min., 16 mm., color, sound.

Behavior Theory in Practice Part III. 20 min., 16 mm., color, sound.

Behavior Theory in Practice Part IV. 20 min., 16 mm., color, sound.

APPLIED MEAT AND POULTRY INSPECTION

Hours Per Week

Class, 3; Laboratory, 4

Course Description

A course designed to involve the student in actual inspection procedures, techniques and decisions. The lectures discuss specific inspection techniques, while laboratory sessions give the student experience in practical problem-solving situations. Sessions in slaughter facilities permit students to apply newly learned skills under simulated working conditions.

Major Divisions

	Class Hours
I. Facilities and Equipment	3
II. Slaughter (All Species)	4
III. Abnormalities, Diseases and Ante-Mortem Inspection	3
IV. Post-Mortem (Cattle)	4
V. Post-Mortem (Swine)	3
VI. Post-Mortem (Poultry)	2
VII. Edible Parts, Inedible, and Condemned	4
VIII. Restricted Products and Moisture Control	2
IX. Marking, Cutting, Packaging and Labeling	4
X. Reinspection and Sampling	3
XI. Applied Sanitation I	3
XII. Applied Sanitation II	3
XIII. Applied Processing I	3
XIV. Applied Processing II	2
XV. Forms and Reports Summary	3
XVI. Procedures Review	2
Total	48

Units of Instruction

I. Facilities and Equipment
- A. Literature
- B. General considerations
- C. Blueprints
- D. Principles of construction and use

II. Slaughter (All Species)
- A. Identification through inspection
- B. Restraint
- C. Death
- D. Blood
- E. The head
- F. The carcass and viscera
- G. After inspection — if passes
- H. Knowledge of plant processes

III. Abnormalities, Diseases and Ante-Mortem Inspection
- A. Abnormalities and diseases
- B. Ante-mortem inspection

IV. Post-Mortem (Cattle)
- A. Plant review
- B. Sanitary dressing
- C. Inspection
  1. Cervical
  2. Viscera inspection
  3. Rail inspection
  4. Other inspection activities

V. Post-Mortem (Swine)
- A. Plant review
- B. Sanitary dressing
- C. Inspection
  1. Cervical
  2. Viscera inspection
  3. Rail inspection
  4. Other inspection activities

VI. Post-Mortem (Poultry)
- A. Plant review
- B. Sanitary considerations
- C. Inspection during slaughter
- D. Other inspection activities

VII. Edible Parts, Inedible and Condemned
- A. Edible parts
  1. General
  2. Cattle
  3. Swine
  4. Poultry
- B. Inedible parts
  1. General
  2. Cattle
  3. Swine
  4. Poultry
  5. Variations
  6. Animal food
  7. Pharmaceutical use
  8. Inspection requirements
- C. Condemned parts
  1. General
  2. Cattle
  3. Swine
  4. Poultry

5. Variations
6. Inspection requirements

D. Tanking
1. Rendering
2. Oil — obviously inedible
3. Oil — appearance of edible
4. Solids
5. Blood
6. Inspection requirements

VIII. Restricted Products and Moisture Control
A. Restricted products
1. General considerations
2. Treatment of product
3. Alternatives to treatment
4. Records

B. Moisture control
1. Why necessary
2. The chill procedure
3. The moisture test
4. Allowed pickup
5. Excessive water pickup

IX. Marking, Cutting, Packaging and Labeling
A. Marking
1. General
2. Cattle
3. Swine
4. Poultry
5. Grading

B. Cutting
1. General considerations
2. Cattle
3. Swine
4. Poultry

C. Packaging
1. Kinds of containers and wrapping
2. Sizes of packages
3. Composition

D. Labeling
1. General
2. Meat labels
3. Poultry labels
4. Official references
5. Trends

X. Reinspection and Sampling
A. Reinspection — general considerations
B. "Scheduled" reinspection and sampling
1. Statistical quality control
2. Surveillance

C. "Unscheduled" reinspection and sampling
1. During operations
2. "Odd hours" inspections

D. Forms and reports

E. Sampling
1. General considerations
2. Sampling programs
3. Pathological sampling
4. Specific examples

XI. Applied Sanitation I
A. Sanitation survey
B. Preparation
C. Survey by area
D. Time of survey
E. Records
F. Deficiencies
G. Working examples

XII. Applied Sanitation II
A. Working sanitation
B. Coverage
C. Before slaughter begins
1. "Pre-operative" sanitation
2. Preparation for slaughter-plant
3. Preparation for slaughter-inspector
4. During slaughter operations
5. Breaks, lunch, breakdowns
6. After the slaughter

XIII. Applied Processing I
A. Calculations
B. Additives
1. Purpose
2. Conditions for approval
3. Kinds of additives
4. Control of additives
5. Calculations

XIV. Applied Processing II
A. Composition of characteristics of meat
B. Meat identification
C. Standards of composition
D. Statistical quality control programs
E. Processing forms and reports

XV. Forms and Reports Summary
A. Kill results system
B. Trace through (examples)
C. Plant production system
D. Non-meat items
E. Returned goods
F. Others at the instructor's discretion

XVI. Procedures Review
A. Slaughter inspection routines
1. Meat
2. Poultry

B. Reinspection routines
C. Processing
D. Other reviews to be decided upon by the instructor

Suggested Laboratory Projects (64 hours)

1. Exercises and workshops utilizing the publications on facilities and equipment. (4 hours)
2. Tours of commercial plants (beef and hog slaughter, meat processing and poultry). (8 hours)
3. Review of diseases and abnormalities emphasizing those of significance to inspection and also emphasizing the early changes. Study of advanced disease cases and dead animals which on occasion are sent to slaughter establishments and are easily detected. Stress organoleptic detection. (4 hours)
4. Knife sharpening, care of tools and equipment, security of inspection stamps. (2 hours)
5. Inspection procedures practice. (12 hours)
6. Workshops on sampling. (8 hours)
7. Workshops, films, and exercises in sanitation. (10 hours)
8. Problem solving in processing. (8 hours)
9. Practice exercises in forms and reports completion. (8 hours)

Text and References

Please refer to listing recommended for the Elements of meat and Poultry Inspection course outline, which also applies here.

Instructional Media

At the discretion of the instructor, the same audio-visual references recommended for Elements of Meat and Poultry Inspection may be considered for use here.

APPLIED MICROBIOLOGY

Hours Per Week

Class, 4; Laboratory, 6

Course Description

An advanced course which concentrates on the characteristics of micro-organisms, both pathogenic and non-pathogenic, having an important relationship to animal health, dairy and food processing, as well as public health and meat inspection. Emphasis is directed toward the culture and identification of selected species of these microorganisms.

Serological techniques are studied and practiced in depth as they relate to the diagnostic and public health aspect of microbiology. Laboratory exercises correlated with the lecture sequence, provide repeated opportunities for the student to gain proficiency in those diagnostic skills essential to employment success.

Major Divisions

	Class Hours
I. Isolation and Identification of Bacteria	4
II. Infection and Immunity	6
III. Dairy and Food Microbiology	6
IV. Antibiotics and Chemotherapy	3
V. Public Health Microbiology	6
VI. Serology	8
VII. The Schizomycetes	22
VIII. The Microtatobiotes	4
IX. The Pathogenic Fungi	5
Total	64

Units of Instruction

I. Isolation and Identification of Bacteria
- A. Specimen care
- B. Enrichment
- C. Pure culture
- D. Differentiation
- E. Morphology
- F. Cultural characteristics
- G. Biochemical reactions
- H. Serological identification

II. Infection and Immunity
- A. The inflammatory response
  1. Irritants
  2. Microorganisms and disease
  3. Infection and resistance
  4. Inflation
- B. The immune response
  1. Antigens and antibodies
  2. Types of immunity
  3. Antibody production
  4. Allergy, anaphylaxis and hypersensitivity

III. Dairy and Food Microbiology
- A. Beneficial and contaminant bacteria
  1. Organisms used in food manufacture
  2. Organisms causing fermentation
  3. Acid production in dairy foods caused by microorganisms
- B. Factors influencing dairy and food processing
  1. The pasteurization process
  2. Heat in the processing of food products
  3. The need for variation in food processing methods
- C. Quality control
  1. Sampling methods
  2. Sample processing
  3. Sterility tests

IV. Antibiotics and Chemotherapy
- A. Therapeutic agents
  1. Sulfonamides
  2. Penicillin
  3. Streptomycin
  4. Tetracyclines
  5. Nitrofurans
- B. Sensitivity, resistance and concentrations
  1. Disc sensitivity tests
  2. Fluid titration tests
  3. Determination of serum levels

V. Public Health Microbiology
- A. Water
  1. Collection of specimens
  2. Enumeration of viable bacteria
  3. Quantitative *E. coli* tests
  4. Determination of chlorine content
- B. Sewage
- C. Air
  1. Slit samplers
  2. Filters
  3. Open plate methods
- D. Surfaces
  1. Swabbing
  2. Rodac technic

VI. Serology
- A. The use of known antibodies

1. Slide agglutination tests
2. Tube agglutination tests
3. Tests for precipitins

B. The use of known antigens
1. Titration of serum to determine antibody concentrations
2. Hemagglutination
3. Hemagglutination — inhibition
4. Complement fixation

VII. The Schizomycetes
A. Pseudomonadaceae
1. Pseudomonas
2. Alcaligenes

B. Lactobacteriaceae
1. Lactobacillus
2. Streptococcus
3. Diplococcus

C. Brucellaceae
1. Pasteurella
2. Malleomyces
3. Brucella
4. Hemophilus
5. Bordetella

D. Micrococcaceae
1. Staphylococcus
2. Gaffkya
3. Sarcina

E. Enterobacteriaceae
1. Escherichia
2. Enterobacter
3. Klebsiella
4. Proteus
5. Salmonella
6. Shigella
7. Serratia

F. Bacillaceae
1. Bacillus
2. Clostridium

G. Spirillaceae
1. Vibrio
2. Spirillum

H. Bacteriodaceae
1. Bacteriodes
2. Fusobacterium

I. Corynebacteriaceae
J. Mycobacteriaceae
K. Actinomycetaceae
L. Mycoplasmataceae
M. Spirochaetales
1. Borrelia
2. Treponema
3. Leptospira

N. Neisseriaceae

VIII. The Microtatobiotes
A. Rickettsiales
1. Rickettsia
2. Bartonella

B. Virales

IX. The Pathogenic Fungi
A. Dermatophytoses
1. Trichophyton
2. Epidermophyton
3. Microsporum

B. Systemic Mycoses
1. Cryptococcus
2. Candida
3. Coccidioides
4. Histoplasma

Suggested Laboratory Projects (96 hours)

1. Prepare (dehydrated) media, blood agar, triple sugar iron agar. (3 hours)
2. Prepare (dehydrated) media, deoxycholate citrate agar, glucose fermentation broth. Inoculate media from labs. 1 and 2 to obtain isolated colonies and/or demonstrate typical reactions. (3 hours)
3. Study cellular and colonial morphology of typical gram positive and gram negative rods and cocci. Inoculate TSI media with organisms from each genus of the enterobacteriaceae. (3 hours)
4. Correlate TSI results with genus of organism. Prepare a suspension of 'O' antigens from S. typhimurium. Prepare suspension of phase 1 'H' antigens from S. typhimurium. (3 hours)
5. Inoculate rabbits with either the 'O' or 'H' antigens. Observe phagocytosis in vitro. Inoculate rabbit with sheep red blood cells for hemolysin production. (3 hours)
6. Study histological preparations illustrating the inflammatory process. (3 hours)
7. Continue inoculation of rabbits. Study milk specimens for causative organisms of mastitis. (3 hours)
8. Study food (hamburger, yogurt) for presence of contaminating organisms. (3 hours)
9. Continue inoculation or rabbits. Determine sensitivity of streptococcus, pseudomonas and staphylococcus by disc technic. (3 hours)
10. Determine antibiotic concentration in serum by titration technic. (3 hours)
11. Continue inoculation of rabbits. Study action of penicillin on cell wall of E. coli. (3 hours)
12. Determine number of viable bacterial aggregates in a specimen of water. Compare

results of incubation at 20° and 37°. (3 hours)

13. Continue inoculation of rabbits. Determine most probable number (MPN) of coliform organisms in a specimen of water. (3 hours)
14. Prepare media and conduct confirmation tests on coliforms from lab. 13. (3 hours)
15. Prepare media and pour rodac plates. Inoculate these plates from surfaces in kitchen and determine levels of contamination of kitchen surfaces. (3 hours)
16. Exsanguinate rabbits and prepare vials of the various antisera. (3 hours)
17. Determine chlorine levels in specimens of tap and swimming pool water. (3 hours)
18. Demonstrate slide agglutination using antigens from lab. 4 and antisera from lab. 16. Perform titration of sera containing 'O' salmonella antibodies using S. typhimurium and S. newport antigens to demonstrate differences of somatic antigens. (3 hours)
19. Perform titrations of serum containing 'H' salmonella antibodies using S. typhimurium and S. newport antigens to demonstrate differences in flagellar antigens. (3 hours)
20. Perform titration of hemolytic antiserum using sheep red blood cells as antigen and fresh guinea pig serum for complement. (3 hours)
21. Perform complement-fixation test (Wasserman reaction). (6 hours)
22. Perform hemagglutination test using Reo 3 virus antigen to agglutinate human group O red blood cells. (3 hours)
23. Perform hemagglutination-inhibition test using Reo 3 virus antigen, human group O red blood cells, positive and negative test sera. (3 hours)
24. Isolate, identify and determine antibiotic sensitivity of organisms from urine (cystitis specimens). (3 hours)
25. Isolate, identify and determine antibiotic sensitivity of organisms from feces (paratyphoid specimens). (3 hours)
26. Isolate, identify and determine antibiotic sensitivity of organisms from respiratory tracts (3 hours)
27. Isolate, identify and determine antibiotic sensitivity of organisms from the genital tract (mares, cows, etc.). (3 hours)
28. Isolate, identify and determine antibiotic sensitivity of organisms from wounds and abscesses. (3 hours)
29. Isolate, identify and determine antibiotic sensitivity of organisms from blood (septicemic). (3 hours)
30. Isolate, identify and determine antibiotic sensitivity of organisms from eyes and ears (dogs, cats, etc.). (3 hours)
31. Isolate, identify and determine antibiotic sensitivity of organisms from nasal and buccal cavities. (3 hours)

Texts and References

American Public Health Association. *Standard Methods of applied Microbiology.*

Bailey and Scott. *Diagnostic Microbiology.*

Boyd. *Fundamentals of Immunology.*

Breed and others. *Bergey's Manual of Determinative Bacteriology.*

Kelser and Schoening. *Manual of Veterinary Bacteriology.*

Skerman. *Guide to the Identification of the Genera of Bacteria.*

Weiser. *Practical Food Microbiology and Technology.*

Instructional Media

Coronet Films, 65 South Water Street, Chicago, Illinois 60601

Infectious Diseases and Man Made Defenses. 11 min., 16 mm., color, sound.

Infectious Diseases and Natural Body Defenses. 11 min., 16 mm., color, sound.

Microorganisms that Cause Disease. 11 min., 16 mm., color, sound.

Encyclopedia Britannica Films, Inc., 1150 Wilmette Avenue, Wilmette, Illinois 60091

Bacteria. 19 min., 16 mm., color, sound.

Eli Lilly and Company, Audio-Visual Film Library, P.O. Box 618, Indianapolis, Indiana 46206

Triad of Infection. 14-1/2 min., 16 mm., color, sound.

McGraw-Hill, Inc., Text-Film Division, 330 West 42nd Street, Nea York, New York 10036

The Germ Theory of Disease. 28 min., 16 mm., color, sound.

National Medical Audiovisual Center (Annex), Station K, Atlanta, Georgia 30333

Chemical Disinfection. 30 min., 16 mm., color, sound.

Epidemiology of Brucellosis. 15 min., 35 mm. film strip (86 frames), color, sound.

Epidemiology of Murine Typhus. 18 min., 16 mm., black and white, sound.

Epidemiology of Salmonellosis in Man and Animals. 15 min., 16 mm., color, sound.

Epidemiology of Staphylococcal Infections. 13 min., 16 mm., color, sound.

Epizootiology of Anthrax. 9 min., 35 mm. film strip (67 frames), color, sound.

Isolation and Identification of Beta Hemolytic Streptococci. 16 min., 16 mm., color, sound.

The Infectious Diarrheas. 15 min., 16 mm., color, sound.

Tuberculosis: Laboratory Aids to the Diagnosis and Treatment. 13 min., 16 mm., color, sound.

CLINICAL TECHNIQUES

Hours Per Week

Class, 3; Laboratory, 8

Course Description

An introduction to radiological techniques, anesthesia and surgical assisting as involved in the practice of veterinary medicine and in biomedical institutions. Each student learns how to position a patient, calculate exposure values, expose radiographic films and process radiographs of diagnostic quality for the veterinarian to examine.

The student learns the basics of animal anesthesia and surgical assisting by participation in lecture and laboratory sessions. Actions of basic anesthetic agents and tranquilizers are demonstrated and the student is made aware of dangers involved in utilizing these drugs.

Surgical assisting skills are acquired through actual student involvement in a number of different operative procedures performed by a veterinary surgeon. During the laboratory sessions, the class is divided into functional groups of five members each. Two students learn to perform in patient preparation, one in administering and monitoring anesthesia, one as circulating nurse, and one as the direct operative assistant. Team members switch roles in subsequent laboratory periods. This approach provides an opportunity for becoming proficient in each area. Students are to be available after hours, if necessary, to monitor patients recovery from anesthesia or to render any emergency assistance related to their assigned surgical procedure.

Depending upon the class size, surgical procedures may be duplicated live for benefit of the remaining surgical assisting groups, or each type of procedure may be video taped for total class viewing. Where a clinical facility is available, the first approach may be preferable. If there is no clinical facility available, or the class size is very large, the latter approach should be considered. Video tape capability is desirable, in that it provides instant reproducibility of specialized surgical techniques for simultaneous orientation of remaining laboratory groups. All students may thus observe assisting techniques at a close range and use of this media makes demonstration of a larger number of surgical operations possible. After viewing the surgical procedure on video tape, the surgical assistant's role is critically analyzed by the class.

This course follows the Laboratory Techniques course so that additional clinical experience in hematology, urinalysis and parasitology related to patients undergoing surgery can be gained. This sequence is advantageous since it reinforces the skills and proficiencies developed in the earlier course.

Figure 8—A team of technician students practice the specialized techniques of assisting for aseptic surgery, supervised by a veterinary surgeon.

Major Divisions

	Class Hours
I. X-ray Production	2
II. Safety Procedures	2
III. Image Recording	2
IV. Exposure Factors	3
V. Film Storage and Handling	1
VI. Film Processing	1
VII. Introduction to Anesthesia	1
VIII. General Anesthetic Considerations	2
IX. Preanesthetic Drugs	4
X. General Anesthesia	8
XI. Anesthetic Monitoring	4
XII. Anesthetic Emergencies	4
XIII. Introduction to Surgical Assisting	2
XIV. Sterile Technique	4
XV. Surgical Principles	8
Total	48

Units of Instruction

I. X-ray Production
   A. Introduction

1. Radiograph concept in diagnostics
2. X-rays and the physics of X-radiation
3. Construction and operation of an X-ray tube

B. X-ray beam production
1. Central-ray concept
2. Kilovoltage effect

C. X-ray absorption
1. Subject contrast
2. X-ray wave length

D. Image factors
1. Milliamperage and brightness
2. Film-focal distance
3. Kilovoltage and penetration

E. Heel effect

F. Image formation
1. Shadow effect
2. Radiation source
3. Rules for accurate image formation

G. Scatter radiation
1. Effects on contrast
2. Methods of reducing scatter radiation

II. Safety Procedures

A. Introduction and state laws on radiation

B. X-ray protection
1. Tissue involvement
2. Importance of exposure records
3. Establishing good technique
4. Decreasing scatter radiation
5. Instruments used to record radiation
6. Importance of technical competence

C. Electrical safeguards
1. Dangers of electrical shock
2. Shockproof equipment standards
3. "one-hand rule" application
4. Portable veterinary equipment problems

D. Radiographic technical failure
1. Introduction
2. Dark or black radiographs
3. Gray non-contrast radiographs
4. Light or excessively white radiographs
5. Dark spots on radiographs
6. White or light spots on radiographs
7. Streaks, fingerprints and miscellaneous problems

III. Image Recording

A. Methods of recording image
1. Photosensitive film
2. Fluorescent screen

B. Intensifying screens
1. Use of screens
2. Composition of screens
3. Types of screens
4. Screen-film contact

C. X-ray film
1. Composition of film
2. Mechanics of film
3. Types of film

IV. Exposure Factors

A. Intensity and time

B. Film sensitivity

C. Density of radiograph

D. Radiographic contrast

E. Standardization of exposure factors

F. Contrast media and its application

G. Detail
1. Motion effects
2. Subject contrast
3. Definition

V. Film Storage and Handling

A. Storage of film
1. Room requirements
2. Precautions regarding film
3. Systems for dating film

B. Handling sheet film
1. Precautions utilized
2. Film containers
3. Procedures for loading film holders
4. Loading processing hangers

VI. Film Processing

A. Film processing solutions
1. Developer
2. Fixer
3. Water bath

B. Preparation of solutions
1. General precautions
2. Liquid chemicals
3. Dry chemicals

VII. Introduction of Anesthesia

A. Definition of terms
1. Anesthesia
2. Analgesia
3. Tranquilization
4. Sedation
5. Narcosis
6. Hypnosis
7. Local anesthesia
8. Regional anesthesia
9. Basal anesthesia
10. General and surgical anesthesia

B. Reasons for administration of anesthesia
1. Restraint
2. Examination
3. Manipulation
4. Surgery

5. Convulsion control
6. Euthanasia

C. Types of anesthesia
1. Inhalation
2. Intravascular
3. Topical, infiltration and conduction
4. Electronarcosis
5. Hypothermia

VIII. General Anesthetic Considerations
A. Anesthetic factors
1. Relative size
2. Physical condition
3. Age and sex
4. Recent feedings and activities
5. Preanesthetic medication
6. Fear and excitement
8. Concurrent diseases and drug administration
8. Anesthetic agents and tolerance
9. Available facilities

B. Physical examination
1. Areas of examination
2. Ancillary examinations

C. Selection of anesthetic agent
1. Qualities of an ideal anesthetic agent
2. Practical consideration for agents
3. Precautions regarding anesthetic agents

D. Preparation of patient
1. Feeding and water availability
2. Antibiotic utilization
3. Correction of anemic conditions
4. Preparation procedures

IX. Preanesthetic Drugs
A. Uses of preanesthetic drugs
B. Types of preanesthetic drugs
1. Anticholinergics
2. Tranquilizers
3. Morphine and morphine substitutes
4. Miscellaneous agents

C. Discussion of specific drugs
D. Drug abuse
1. Heroin, morphine
2. Lysergic acid diethylamide
3. Cannibis

X. General Anesthesia
A. Stages of anesthesia
1. Analgesia
2. Delirium
3. Surgical anesthesia
4. Depression and death

B. Inhalation anesthesia
1. Introduction
2. Liquid inhalant anesthetic agents
3. Gaseous inhalant anesthetic agents
4. Methods of induction and maintenance
5. Halothane and Methoxyflurane

C. Respiration and respiratory physiology
1. Acid-base balance
2. Acidosis and alkalosis
3. Hypoxia types, symptoms and effects

D. Barbiturate anesthesia
1. Introduction
2. Classification of barbiturates
3. Therapeutic uses of barbiturates
4. Pentobarbital sodium
5. Thiopental sodium and Thiamylal sodium
6. Routes of barbiturate anesthesia administration
7. Barbiturate slough

XI. Anesthetic Monitoring
A. Respiratory rate and quality
B. Pulse rate and quality
C. Heart rate and quality
D. Blood pressure
E. Temperature variations
F. Electroencephalogram
G. Practical veterinary anesthesia monitoring

XII. Anesthetic Emergencies
A. Blood and blood substitutes
B. Vasopressors
1. Pharmacology of epinephrine
2. Pharmacology of Amphetamine
3. Amphetamine abuse

C. Adrenocorticotropic and adrenocorticosteriod therapy
1. Adrenocorticotropic hormone
2. Steroid pharmacology and clinical use

D. Cardiac defibrillator
E. Analeptic pharmacology
1. Pentylenetetrazol
2. Methetharimide
3. Doxopram hcl

F. Respiratory resuscitation
G. Cardiac resuscitation

XIII. Introduction to Surgical Assisting
A. History of surgery
1. Prehistoric
2. Hippocrates
3. Semmelweiss
4. Pasteur
5. Lister

B. Current Status of Surgery in Veterinary Medicine
1. Small animal practice

2. Large animal practice
3. Laboratory animal practice

XIV. Sterile Technique
- A. Microorganism contamination
- B. Sterile equipment
- C. Cold sterilization
  1. General use
  2. Vegetative bacteria
  3. Disadvantages
  4. Use in cutting instruments
- D. Heat sterilization
  1. Dry heat
  2. Moist heat (autoclave, boiling)
  3. Advantages and disadvantages
- E. Operating room
  1. Construction of operating theater
  2. Procedures in operating theater
  3. Infected wound surgery
  4. Contamination
- F. Patient preparation
  1. Clipping surgical site
  2. Surgical scrub
  3. Positioning
  4. Draping
- G. Preparation of surgeon and surgical assistant
- H. Preparation of surgical packs and other sterile equipment and supplies

XV. Surgical Principles
- A. Preoperative considerations
  1. Emergency surgery vs elective surgery
  2. Clinical pathology examinations
  3. Radiological examinations
  4. Use of antibiotics
  5. Use of adrenocorticosteroids
- B. Hemorrhage and hemostasis
  1. Types of hemorrhage
  2. Effects of hemorrhage
  3. Causes of hemorrhage
  4. Natural hemostasis
  5. Artificial hemostasis
  6. Electrocautery and electrocoagulation
  7. Topical hemostasis
  8. Coagulants
  9. Systemic hemostatic agents
- C. Wound healing
  1. Closed wounds (contusions)
  2. Incisions
  3. Lacerations
  4. Punctures
- D. General factors in wound healing
  1. Epithelialization
  2. Contraction
  3. Connective tissue repair
  4. Healing rates
- E. Local factors in wound healing
  1. Blood supply to area
  2. Nerve supply to area
  3. Degree of tissue trauma
  4. Foreign bodies in wound
  5. Improper closure of wound
- F. Systemic factors in wound healing
  1. General health of animal
  2. Vitamin deficiencies
  3. Neoplasia
  4. Age of patient
  5. Obesity
  6. Anemia
  7. Hypoproteinemia
  8. Hormonal imbalances
- G. Wound infection
  1. Bacterial contamination
  2. Use of antiseptics
- H. Wound treatment and protection
  1. Debridement
  2. Use of enzymes
  3. Bandaging procedures
  4. Waterproofing
- I. Wound dehiscense
  1. Causes of dehiscense
  2. Signs of dehiscense
- J. Sutures and suture patterns
  1. Terminology
  2. Use of sutures
  3. Strength of sutured wound
  4. Absorbable suture material
  5. Silk suture
  6. Cotton suture
  7. Nylon suture
  8. Stainless steel suture
  9. Wound clips
  10. Relative tissue strength
  11. Tensile strength of suture materials
  12. Tissue reaction to suture materials
  13. Interrupted and continuous suture patterns
  14. Mattress suture patterns
  15. Cushing and Connell suture patterns
  16. Purse string suture patterns

Suggested Laboratory Projects (128 hours)

1. Radiology (total 34 hours)
   a. Orientation to radiology laboratory.
   b. Demonstration of protective equipment used in radiology.

c. Demonstration of stationary x-ray unit.
d. Demonstration of portable x-ray unit.
e. Demonstration of production of radiographs of diagnostic quality.
f. Exhibit of radiographs of insufficient diagnostic quality and reasons for occurrence.
g. Demonstration of radiographic screens and various types utilized in veterinary radiology.
h. Students expose a series of radiographs and compare variations of exposure factors.
i. Demonstrations of contrast media methods.
j. Demonstration of film storage methods.
k. Student will load film processing hangers.
l. Demonstration of x-ray processing techniques.
m. Student develops, fixes and processes exposed radiographs as assigned throughout remainder of this course.

2. Anesthesiology (total 34 hours)
   a. Orientation to the surgery laboratory.
   b. Introduction to pharmacy, drug control and precautions necessary.
   c. Perform presurgical examination on canine and feline patients for vital signs and hematology, urinalysis and other ancillary examinations.
   d. Observation of demonstrations of various anesthetic agents and note the effects on each individual patient.
   e. Injection of laboratory animals with various preanesthetic drugs in the laboratory. Students will note the reactions observed in each patient.
   f. Physiograph demonstration of various parameters utilized to monitor preanesthetic and general anesthetic medications.
   g. Weekly laboratory sessions involving patient preparation, barbiturate anesthesia, endotracheal intubation, inhalant anesthesia, surgical preparation and observation of induction and recovery involving the different anesthetic agents. This series of laboratory projects extends over a period of weeks in order for each student to develop a sufficient degree of competence in the multifaceted areas of successful and safe anesthesia.
   h. Clinical monitoring of anesthesia is conducted in the laboratory.
   i. Demonstration of specialized equipment used for anesthetic emergencies.
   j. Demonstration of various drugs and methods utilized during anesthetic emergencies.

3. Surgical assisting (total 60 hours)
   a. Prepare patient for surgery
      (1) Bathing
      (2) Pre-operative blood, serum, and urine analysis
      (3) Anesthetization of patient under supervision of the veterinarian.
         (a) Short acting barbiturates or other anesthetic agent
         (b) Intubation and inhalation anesthesia
      (4) Clipping of surgical site
      (5) Surgical scrub and disinfection of surgical site
      (6) Position patient appropriately on operating table for type operative procedure being performed
      (7) Apply sterile surgical drapes to patient
   b. The student will assist the veterinary surgeon directly in the operative procedures. Techniques involved will vary with the individual surgeon being assisted and with the specific procedure performed. The assisting experience involves both small and large animal surgical procedures.
   c. Post-operative recovery is monitored by the student group. Clinical pathology examinations are performed as requested by the surgical assisting instructor. Students are also responsible for administering post-operative medications as prescribed and under the supervision of the veterinary surgeon.
   d. Operative procedures suggested for class demonstrations include:
      (1) Canine and feline ovariohysterectomy
      (2) Canine, feline, equine and bovine castration
      (3) Canine and feline cystotomy
      (4) Canine and feline gastrotomy
      (5) Canine thoracotomy
      (6) Bovine displaced abomasum repair
      (7) Bovine, canine and feline cesarean section
      (8) Bovine rumenotomy
      (9) Canine femoral fracture repair
      (10) Canine enucleation

Texts and References

Abbatt and others. *Protection Against Radiation.*
Archibald and others. *Canine Surgery.*
Cahoon. *Formulating X-Ray Techniques.*

Carlson. *Veterinary Radiology.*
Catcott. *Animal Hospital Technology: A Manual for Veterinary Aides.*
———. *Canine Medicine.*
———. *Progress in Canine Practice - Part I, Modern Veterinary.*

Reference Series.

Catcott and others. *Equine Medicine and Surgery.*
Collins. *Principles of Anesthesiology.*
Eastman Kodak Company. *The Fundamentals of Radiology.*
Epstein. *Skin Surgery.*
Fletcher. *Textbook of Radio Therapy.*
Fuchs. *Principles of Radiographic Exposure and Processing.*
Ginsburg and others. *Manual of Operating Room Technology.*
Hall. *Wright's Veterinary Anesthesia and Analgesia.*
Jones. *Animal Nursing, Part I.*
———. *Animal Nursing, Part II.*
Leonard. *Fundamentals of Small Animal Surgery.*
Lumb. *Small Animal Anesthesia.*
Mayer and others. *Canine Surgery.*
Ormond. *Surgery of the Dog and Cat: A Practical Guide.*
Perkins. *Principles and Methods of Sterilization in Health Sciences.*
Smith. *Electrical Anesthesia.*
Westhues and Fritsch. *Animal Anesthesia - General Anesthesia, Vol. II.*
———. *Animal Anesthesia - Local Anesthesia, Vol. I.*

Instructional Media

Abbott Laboratories, Film Library, North Chicago, Illinois 60600
Fire and Explosion Hazards from Flammable Anesthetics. 30 min., 16 mm., color, sound.

American Animal Hospital Association, Film Library, 3920 East Jackson Boulevard, Elkhart, Indiana 46514
Preparation for Aseptic Surgery. 45 min., 16 mm., black and white, sound.

American Society for Microbiology, Ann Arbor, Michigan 48103
Venipuncture. 12 min., 16 mm., color, sound.

Ayerst Laboratories, 685 Third Avenue, New York, New York 10000
Principles of Inhalation Anesthesia in Domestic Animals. 40 min., 16 mm., color, sound.

Bectin, Dickinson, Inc., Rutherford, New Jersey 07070
Collecting Blood Samples. 20 min., 16 mm., color, sound.

Davis and Geck, American Cyanamid Co., Danbury, Connecticut 06810
Fundamental Aseptic Techniques. 21 min., 16 mm., color, sound.
Gloving and Gowning for Surgery. 12 min., 16 mm., color, sound.

UFA Films, RKO Building, New York, New York 10000
Moving X-Rays. 11 min., 16 mm., black and white, sound.

COMPARATIVE ANATOMY AND PHYSIOLOGY

Hours Per Week
Class, 4; Laboratory, 6

Course Description

A comprehensive applied course designed to provide the veterinary science technology student with a working knowledge of cells, tissues, and organs which comprise the mammalian organism. Emphasis is placed upon a conceptual approach, relating structure to function. Anatomical areas having clinical significance are stressed.

The study develops a broad base of understanding in the area of medical terminology as well as in the area of form and function. All technical courses which follow will rely heavily upon basic language and concepts developed here. Therefore, mastery of the subject matter presented in each segment of this course is essential to the students' successful advancement in this program.

The anatomical and physiological principles advanced in lecture are confirmed through laboratory experience. To achieve this end, student groups learn through dissection of preserved mammalian (preferably canine) cadavers, prepared histological sections and demonstrations of physiological principles and phenomena. Live animals are also utilized in the laboratory to enable students to palpate and relate structures learned on the cadaver which have clinical importance. At this time, such structures as superficial veins (used in veinpuncture), superficial arteries (for obtaining pulse), and common intramuscular injection sites are stressed.

Throughout the course, anatomical and physiological similarities and differences between various mammalian species are noted. Illustrations drawn from the instructor's veterinary practice or laboratory animal research experience are effective in stressing to the student the importance of understanding anatomical and physiological principles and relationships. Audio-visual aids are utilized at every opportunity, in both lecture and laboratory, to reinforce and provide a more complete understanding of the subject matter presented by the instructor.

Major Divisions

	Class Hours
I. Introduction to Anatomy and Physiology	4
II. Microscopic Anatomy: Animal Cells, Tissues and Organs	5
III. The Skeletal System	6
IV. The Joints	2
V. The Muscular System	4
VI. The Circulatory System	10
VII. The Respiratory System	4
VIII. The Digestive System	12
IX. The Urinary System	3
X. The Reproductive System	7
XI. The Endocrine System	3
XII. The Integumentary System	1
XIII. The Nervous System	3
Total	64

Units of Instruction

I. Introduction to Anatomy and Physiology
- A. Definitions
- B. Need for study of anatomy and physiology
- C. Specialized subdivisions of anatomical study
- D. Descriptive anatomical terminology
- E. Medical etymology

II. Microscopic Anatomy: Animal Cells, Tissues and Organs
- A. Cells
  1. Typical cell structure
  2. Cell types and specialization
  3. Somatic
  4. Germ
- B. Tissues
  1. Epithelial
  2. Connective tissue
  3. Muscular tissue
  4. Nervous tissue
- C. Organs
  1. Component tissues
  2. As units of body systems

III. The Skeletal System
- A. Terminology and classification
- B. Functions of bone
- C. Skeletal parts
- D. Micro-anatomy of bone
- E. Bone formation
- F. Physio-pathology of bone

IV. The Joints
- A. Classification by types and action
- B. Identification of joints in relation to skeletal parts
- C. Pathology of joints and related structures

V. The Muscular System
- A. Functional grouping of muscles
- B. Related synovial structures
- C. Major muscles of the front limb
- D. Major muscles of the hind limb
- E. Abdominal muscles
- F. Muscle physiology
  1. Micro-structure of skeletal muscle
  2. Mechanics of contraction
  3. Chemistry of contraction
  4. Heat production
  5. Muscle fatigue
- G. Muscle pathology

VI. The Circulatory System
- A. The heart and associated structures
- B. Vessels
- C. Blood and other body fluids
  1. General considerations
  2. Cellular components
     a. Erythrocytes
     b. Leukocytes
        (1) Granulocytes
        (2) Agranulocytes
     c. Thrombocytes
  3. Fluid component of blood
     a. Plasma
     b. Serum
     c. Blood clotting mechanisms
  4. Blood volume
  5. Introduction to clinical hematology
  6. Lymph
  7. Cerebrospinal fluid
  8. Synovial fluid
- D. Component parts of the circulatory system
  1. Pulmonary circulation
  2. Systemic circulation
  3. Hepatic portal system
  4. Fetal circulation
- E. Lymph nodes
- F. Spleen
- G. Hemal lymph nodes
- H. Physiology of circulation
- I. Pathology of the circulatory system

VII. The Respiratory System
- A. General functional considerations
- B. Component organs and structures of the respiratory tract
- C. Physiology of respiration
- D. Pathology of the respiratory system

VIII. The Digestive System
- A. Organs and other anatomical structures comprising the gastrointestinal tract
  1. Oral cavity
     a. Teeth
     b. Tongue
     c. Palate
  2. Pharynx
  3. Esophagus
  4. Simple stomach
  5. Ruminant stomach
  6. Small intestine
  7. Large intestine
  8. Anal orifice and related structures
- B. Accessory digestive organs
  1. Salivary glands
  2. Pancreas
  3. Liver
- C. Essential foodstuffs
- D. Digestion of foods
- E. Metabolism of foods
- F. Liver functions
- G. Liver pathology
- H. Liver function tests

IX. The Urinary System
- A. Anatomy of the kidney
- B. Kidney functions
- C. Anatomy and physiology of the ureter, bladder and urethra
- D. Pathology of the urinary system

X. The Reproductive System
- A. Female reproductive system
  1. Anatomy of the reproductive tract
  2. Physiology of the reproductive tract
     a. Puberty
     b. Oogenesis
     c. Ovulation and corpus luteum formation
     d. Estrus cycles of selected species
  3. Hormones of female reproduction
  4. Pregnancy and parturition
     a. Gestation periods of selected species
     b. Fertilization
     c. Implantation
     d. Types of placentation
     e. Pregnancy diagnosis
     f. Act and events of parturition
  5. Pathology of the female reproductive system
- B. Male reproductive system

1. Anatomy of the reproductive tract
2. Physiology of male reproduction
3. Castration
4. Condition of cryptorchidism
5. Pathology of the male reproductive system

XI. The Endocrine System
- A. General considerations
- B. The pituitary gland
- C. The adrenal gland
- D. The thyroid gland
- E. The parathyroid gland
- F. Hormones of the pancreas
- G. Review of the hormones of the ovary and testis

XII. The Integumentary System
- A. General considerations
- B. The skin
- C. The foot and hoof of solipeds (Equidae)
- D. The foot and hoof of bipeds (Ruminants, Porcine)
- E. Horn structures
- F. Nails of carnivores
- G. Mammary glands (accessory integumental organs)
  1. Anatomy of mammary glands
  2. Milk secretion
  3. Colostrum
  4. Hormonal control of mammary gland development and milk "let-down"
  5. Pathology of the mammary gland

XIII. The Nervous System
- A. General anatomical organization of the nervous system
  1. Central nervous system
  2. Pheripheral nervous system
- B. Embryology of the nervous system
- C. Histology of the nervous system
- D. Gross anatomical components of the central and peripheral nervous systems
- E. Physiology of the nerve impulse
- F. Pathology of the nervous system
- G. Sense organs
  1. Taste
  2. Olfactory
  3. Sight
  4. Hearing and balance
  5. Other

Suggested Laboratory Projects (96 hours)

1. Care and use of the microscope; introduction to basic tissue histology — epithelia. (3 hours)
2. Basic tissue histology continued — connective tissue. (3 hours)
3. Basic tissue histology continued — muscular and nervous tissues. (3 hours)
4. Osteology of the canine utilizing skeletons and radiographs. (3 hours)
5. Comparative osteology — bovine, equine, feline, rodentia, primate, and avian. (6 hours)
6. Myology of the canine — musculature of the neck and pectoral limb. (3 hours)
7. Myology of the canine — musculature of the pelvic limb and trunk. (3 hours)
8. Dissection of the viscera of the thoracic cavity — lungs, heart, and branches of the thoracic aorta; thoracic venous system. (3 hours)
9. Dissection of the viscera of the thoracic cavity concluded; histology of the respiratory system. (3 hours)
10. Dissection of the clinically significant arteries, veins and nerves of the limbs. (3 hours)
11. Applied anatomy demonstrations followed by student practice in pulse monitoring, venipuncture and intra-muscular injections utilizing live animals. (3 hours)
12. Monitoring of physiological events and collection of data utilizing the physiograph machine, student analysis of this data. (3 hours)
13. Dissection of the abdominal viscera of the dog. (6 hours)
14. Anatomy of the ruminant stomach, gross and microscopic. (3 hours)
15. Microscopic anatomy of the tongue, esophagus, stomach, intestines, liver, pancreas and salivary glands. (3 hours)
16. Microscopic anatomy of the spleen, lymph nodes, tonsils, and thymus. (3 hours)
17. Gross and microscopic anatomy of the canine urinary system. (3 hours)
18. Gross and microscopic anatomy of the canine endocrine system. (3 hours)
19. Gross and microscopic anatomy of the male and female reproductive systems. (6 hours)
20. Gross anatomy of the hoof of the equine and bovine. (3 hours)
21. Microscopic anatomy of the integumentary system: skin, mammae, hoof of equine and bovine. (3 hours)
22. Gross dissection of the brain and spinal cord. (3 hours)
23. Microscopic anatomy of the brain and spinal cord. (3 hours)
24. Dissection of the eye and adnexia. (3 hours)
25. Microscopic anatomy of the eye and ear. (3 hours)

26. Ophthalmoscopic examination of the eye and otoscopic examination of the ear of the canine. (3 hours)
27. Neurological (reflex) examination of the canine and feline. (3 hours)
28. Comparative gross anatomy of various species of laboratory rodents (fresh specimens). (3 hours)
29. Gross and microscopic anatomy of the chicken. (3 hours)

Texts and References

Baer. *Comparative Anatomy of Vertebrates.*
Bloom and Fawcett. *A Textbook of Histology.*
Booth and Chiasson. *Laboratory Anatomy of the Cat.*
Chiasson. *Laboratory Anatomy of the White Rat.*
Christensen and Evans. *Guide to the Dissection of the Dog.*
Crouch. *Functional Human Anatomy.*
Dukes. *The Physiology of Domestic Animals.*
Frandson. *Anatomy and Physiology of Farm Animals.*
McLeod. *Bovine Anatomy.*
Miller and others. *Anatomy of the Dog.*
Stedman and others. *Stedman's Medical Dictionary.*
Taylor. *Regional and Applied Anatomy of the Domestic Animals, Part I — Head and Neck, Part II — Thoracic Limb, Part III — Pelvic Limb, Part IV — Thorax and Abdomen.*
Trautmann and Fiebiger. *Fundamentals of the Histology of Domestic Animals.*
Wischnitzer. *Atlas and Dissection Guide for Comparative Anatomy.*

Instructional Media

American Medical Association, Motion Picture Library, 535 North Dearborn Street, Chicago, Illinois 60610
Exploring the Human Nervous System. 23 min., 16 mm., color, sound.

Coronet Films, 63 East South Water Street, Chicago, Illinois 60601
Human Body: Digestive System. 14 min., 16 mm., black and white, sound.
Human Body: Muscular System. 13-1/2 min., 16 mm., black and white, sound.
Human Body: Nervous System. 13-1/2 min., 16 mm., black and white, sound.
Human Body: Respiratory System. 13-1/2 min., 16 mm., black and white, sound.
Human Body: Sense Organs. 18-1/2 min., 16 mm., color, sound.

Eli Lilly and Company, Audio-Visual Film Library, P.O. Box 618, Indianapolis, Indiana 46206
Kidney Function in Health. 38 min., 16 mm., color, sound.

Encyclopedia Britannica Films, Inc., 1150 Wilmette Avenue, Wilmette, Illinois 60091
Digestion of Foods. 11 min., 16 mm., black and white, sound.
Mechanisms of Breathing. 11 min., 16 mm., black and white, sound.

Syracuse University, Film Rental Center, 1455 East Colvin Street, Syracuse, New York 13210
Alimentary Tract. 11 min., 16 mm., black and white, sound.
Blood. 16 min., 16 mm., color, sound.
Circulation (AIBS). 28 min., 16 mm., color, sound.
Endocrine Glands. 11 min., 16 mm., black and white, sound.
Form and Function (AIBS). 28 min., 16 mm., color, sound.
Functions of the Body. 15 min., 16 mm., black and white, sound.
Heart and Circulation. 11 min., 16 mm., black and white, sound.
Hearts and Circulatory Systems. 14 min., 16 mm., color, sound.
Heart, Lungs and Circulation. 11 min., 16 mm., color, sound.
Heart: How It Works. 11 min., 16 mm., black and white, sound.
Lesson in Anatomy. 9 min., 16 mm., black and white, sound.
Muscles and Bones of the Body. 11 min., 16 mm., color, sound.
Work of the Blood. 13 min., 16 mm., color, sound.
Work of the Kidneys. 11 min., 16 mm., black and white, sound.

Figure 9—As illustrated here, a laboratory for instruction in Comparative Anatomy and Physiology requires a variety of instructional models (skeletal as well as cadavers). The equipment, work tables, and work spaces demonstrated here represent one example of a very satisfactory facility for this type of course.

ELEMENTS OF MEAT AND POULTRY INSPECTION

Hours Per Week
Class, 3; Laboratory, 4

Course Description

A course designed to acquaint students with the general elements of regulatory functions as they apply to meat and poultry inspection. The subject matter includes the objectives of inspection, history, methods used, and the principles on which inspection is based. Laboratory sessions and experience outside the classroom involve the student in actual demonstrations of inspection methods and principles at work.

Major Divisions

	Class Hours
I. History of Meat Inspection	3
II. General Principles of Inspection	3
III. Official Federal References	2
IV. The Organization of Inspection Service	2
V. Cooperation with Other Groups	2
VI. An Industry Profile	2
VII. Economics	3
VIII. Industry Byproducts and Wastes	3
IX. Food-Borne Conditions	4
X. Elements of Sanitation	4
XI. Elements of Safety	4
XII. Introduction to Processing I	4
XIII. Introduction to Processing II	4
XIV. Relationship of Inspection to the Plant	3
XV. Model Job Study	3
XVI. Review	2
Total	48

Units of Instruction

I. History of Meat Inspection
- A. Meat
- B. Poultry
- C. Other species
- D. Processing
- E. 1967-1968 Acts of Congress
  1. Effects
  2. Future outlook

II. General Principles of Inspection
- A. Goals of in-plant inspection
- B. Methods of achievement of goals
  1. General considerations
  2. Methods of inspection

III. Official Federal References
- A. Meat
- B. Poultry
- C. Both
- D. Usage
- E. Comparison

IV. The Organization of Inspection Service
- A. Federal organization
  1. Structural
  2. Functional
  3. Washington level
  4. Field units
- B. State programs
  1. Requirements
  2. Examples of organizations
- C. Job positions for graduates in meat inspection
  1. Federal meat inspection
  2. State meat inspection
  3. Military
  4. Industry
- D. Advancement in general
  1. Career ladders
  2. Promotions
  3. Training opportunities in general
  4. Self-development in general

V. Cooperation with Other Groups
- A. Animal health
- B. Military
- C. Grading
- D. Investigative, OIG, GAO
- E. States
- F. Counties
- G. Consumer groups
- H. FDA
- I. Foreign countries

VI. An Industry Profile
- A. Production statistics
- B. Trends
- C. Kinds of plants - meat, poultry and processing
- D. Impact on welfare of the country

VII. Economics
- A. Economics of industry
  1. Conversion in slaughter
  2. Variety and convenience in processing
  3. "Value added" concept

4. "Quality standards"
5. "Composition standards"
6. Impact of demand
7. Impact of technology

B. Product flow
1. Grower to slaughter
2. Live to chilled
3. Cooler to consumer
4. Aging

VIII. Industry Byproducts and Wastes
A. Industry byproducts
B. Byproduct control
C. Industry wastes
1. Human wastes
2. Refuse
3. Animal wastes

IX. Food-Borne Conditions
A. "Food poisoning"
1. Epidemiology of human illnesses
2. Common causes
3. Prevention

B. Parasites
C. Residues
1. Kinds
2. Effects
3. Benefits and drawbacks
4. Current use and control

D. Review of microbial zoonoses
1. Epidemiology
2. Kinds
3. Eradication programs

X. Elements of Sanitation
A. Official premises
B. Dimensions of contamination
1. Surroundings
2. Product
3. People
4. Non-meat items
5. Time
6. Contaminants

C. Considerations
1. Cleaning compounds
2. Pesticides
3. Hand creams and cleaners

D. Inspection coverage
1. Scope
2. Importance
3. Chemical compounds list use
4. Labels - read!

XI. Elements of Safety
A. Dimensions of the hazards
1. In-plant factors
2. To and from work
3. Home safety

B. Statistics
C. Safety principles
D. Specific hazards
1. Meat
2. Poultry
3. Processing

E. Safety programs
1. Federal programs
2. State and other programs
3. Plant responsibility
4. Inspector's role

XII. Introduction to Processing I
A. Scope
1. Processing defined
2. Current statistics
3. Official references
4. Impact on economy
5. Role of inspection
6. Trends

B. Basic processes
1. Process approval
2. Basic steps
a. Raw materials
b. Change processes

C. Inspection principles
1. Inspecting the process
2. Sampling the product
3. Statistical quality control programs

XIII. Introduction to Processing II
A. Basic processes
1. Formulation
2. Curing and smoking
3. Rendering and refining
4. Loaf making
5. Sausage making
6. Canning
7. Slicing and packaging

B. Labels and package design
1. Review of label parts
2. The ingredient statement
3. Package design

XIV. Relationship of Inspection to the Plant
A. The role of the plant
1. The agreement
2. Plant responsibility
3. The plant goal-economic survival
4. The role of inspection
5. Inspection responsibility

B. Inspector relationships
1. Working relationships
2. Potential problems

3. Recommended reading

XV. Model Job Study
- A. Meat
  1. Smaller plants
  3. Larger plants
  3. Sheep
- B. Poultry
  1. Smaller plants
  2. Larger plants
  3. Construct the "floor" position
- C. Processing
  1. Smaller plants
  2. Larger Plants
  3. Design coverage for several small plants

XVI. Review - Topics and activities to be decided upon by instructor.

Suggested Laboratory Projects (64 hours)

1. Viewing and discussions of films which emphasize the importance and need for an effective country-wide meat and poultry inspection service. (2 hours)
2. Review of anatomy and physiology of cattle, swine, sheep and poultry. (10 hours)
3. Reading assignments in the various texts followed by structured discussions and exercises. (4 hours)
4. Exercises on using the official references and determining a plan of action from the official instructions. (4 hours)
5. Workshops clarifying the relationship between meat and poultry inspectors and other groups. (4 hours)
6. Workshop outlining the meat and poultry industries and their impact on the welfare of the United States. (2 hours)
7. Food-borne illnesses, epidemiology and residues workshops. (16 hours)
8. Sanitation workshops. (6 hours)
9. Safety workshops. (4 hours)
10. Processing workshops, reading assignments, exercises. (8 hours)
11. Management and supervision, labor-management relations. (4 hours)

Texts and References

American Meat Institute Foundation. *The Science of Meat and Meat Products.*

American Public Health Association Incorporated. *Standard Methods for the Examination of Water and Wastewater.*

Brandly and others. *Meat Hygiene.*

Collins. *Meat Inspection.*

Consumer and Marketing Service, U.S.D.A. *Federal Facilities Requirements for Existing Poultry Plants.*

———. *Federal Facilities Requirements for Small Existing Meat Plants.*

———. *Guidelines for Implementation of Sanitary Requirements in Poultry Establishments.*

———. *List of Chemical Compounds.*

———. *Manual of Meat Inspection Procedures of the U.S.D.A.*

———. *Meat Inspection Regulations.*

———. *Poultry Inspectors' Handbook.*

———. *Sanitation Handbook of Consumer Protection Programs.*

———. *U.S. Inspected Meat Packing Plants.*

Ehlers and Steel. *Municipal and Rural Sanitation.*

Thornton. *Textbook of Meat Inspection.*

United States Public Health Service. *Ordinance and Code.*

Instructional Media

Cornell University, Department of Communication Arts, College of Agriculture, Ithaca, New York 14850

Principles of Food Sanitation. 20 min., 16 mm., color, sound.

Safe Handling of Foods in Quantity. 20 min., 16 mm., color, sound.

Michigan State University, Instructional Media Center (Charles F. Schuller, Director), East Lansing, Michigan 48823 (or from any of the State film libraries of the 50 States.)

Mark of Wholesome Meat, A. 19 min., 16 mm., color, sound.

Your Meat Inspection Service. 28 min., 16 mm., color, sound.

National Medical Audiovisual Center, Atlanta, Georgia 30333

Spread and Prevention of Trichinosis. 12 min., 35 mm., film strip (67 frames), black and white, sound.

The Epidemiology of Salmonellosis in Man and Animals. 15 min., 16 mm., color, sound.

Worms in Your Muscles. 10 min., 35 mm. film strip (52 frames), black and white, sound.

USAF Central Audio-Visual Library, Audio-Visual Center, Norton AFB, California 92409

Poultry Processing Inspection. 22 min., 16 mm., color, sound.

Public Health Aspects of Poultry Processing. 23 min., 16 mm., color, sound.

United States Department of Agriculture, Office of Information, Motion Picture Service, Washington, D. C. 20250

That the Best Will be Ours. 18 min., 16 mm., color, sound.

Veterinarian, USDA. 28 1/2 min., 16 mm., color, sound.

INTRODUCTION TO VETERINARY SCIENCE TECHNOLOGY

Hours Per Week

Class, 2; Laboratory, 6

Course Description

An orientation and survey course introducing the beginning student to basic practices and principles underlying the field of veterinary science technology. Professional requirements and employment opportunities in this broad career field are investigated. Inherited and environmental influences on animal growth and development are studied. Through an exploration of the need for and methods by which animals adapt to and interact with their environments, comfortable conditions necessary for optimum animal performance are defined. This course also presents basic facts relating to pharmaceuticals necessary for compliance with the veterinarian's prescription.

The laboratory sessions provide opportunities to practice those principles, and techniques presented in lecture. They also provide actual experience in those areas most immediately related to the veterinary technician's job responsibilities. Field trips are designed to illustrate practical applications and necessary operational compromises.

Major Divisions

	Class Hours
I. Professional Requirements	1
II. Types of Professional Practice	2
III. Introduction to Materia Medica	3
IV. Animal Nutrition	6
V. Genetics and Animal Breeding	9
VI. Animal Growth	5
VII. Interactions of Animals and Their Environment	6
Total	32

Units of Instruction

I. Professional Requirements
- A. Integrity
- B. Decorum
- C. Responsibility
- D. Ethics

II. Types of Professional Practice
- A. Size
  1. Single practitioner
  2. Partnership
  3. Group practice
  4. Medical centers
- B. Patients
  1. Large animal
  2. Small animal
  3. Mixed practice
  4. Exotic
- C. Other specialties
  1. Research
  2. Industrial
  3. State or federal agencies
  4. Military veterinary corps

III. Introduction to Materia Medica
- A. Drugs
  1. Therapeutic methods
  2. Drug standards
  3. Drug sources
  4. Solid and liquid drugs
  5. Effects of drugs
- B. Preparation of solutions
  1. Review of arithmetic
  2. Metric and avoirdupois systems
  3. Solutions
- C. Fahrenheit and Celsius thermometers

IV. Animal Nutrition
- A. Essential nutrients
  1. Water
  2. Carbohydrates
  3. Fats
  4. Proteins
  5. Minerals
  6. Vitamins
- B. Feeding
  1. Appetite
  2. Prehension
  3. Mastication
  4. Elimination

V. Genetics and Animal Breeding
- A. Fundamental principles
  1. The cell
  2. Chromosomes
  3. Genes
  4. Mitosis
  5. Meiosis
  6. Segregation and recombination
  7. Monohybridism and dihybridism
  8. Phenotype and genotype
  9. Sex linkage

B. Principles of selecting and mating animals
   1. Phenotypic variations in quantitative traits
   2. Frequency of genes in a population
   3. Causes of phenotypic variation
   4. Selection and mating systems

VI. Animal Growth
   A. The phenomenon of growth
   B. Gametogenesis
   C. Fertilization
   D. Prenatal growth and development
   E. Infant growth
   F. Growth from weaning to maturity
   G. Senescence

VII. Interactions of Animals and Their Environment
   A. Heredity and environment
   B. Adaptation to the environment
   C. Stress
   D. Homeothermy and homeostasis
   E. Temperature regulation
   F. Fever - pyrexia
   G. The comfort zone
   H. Heat production and dissipation

Suggested Laboratory Projects (96 hours)

1. Set up breeding experiments with various crosses of inbred strains of mice to demonstrate coat color inheritance. (16 weeks will allow for production of F_2 young) (3 hours)
2. Field trips to various types of veterinary hospitals, clinics or medical centers. (3 hours)
3. Start experiments (4 weeks), using laboratory rats to demonstrate deficiency diseases of specified nutrients. Demonstrate control methods. (3 hours)
4. Start experiments (14 weeks), using 2 x 2 latin square, transparent and opaque filter cap and no filter cap to demonstrate these influences on production of newborn and weaned mice. (3 hours)
5. Arithmetic workshop. Conversion of metric to avoirdupois and vice-versa. Calculation of drug doses from units/gram body weight of specified concentrations. Calculations of disinfectant dilutions. (3 hours)
6. Preparation of normal saline solutions. Preparation of solution of given percent from drug of known percent. Preparation of weaker from stronger solution. (3 hours)
7. Reading and interpretation of feed tags. Determination of moisture content of feed. (3 hours)
8. Determination of fat content of feed. Determination of ash content of feed. (3 hours)
9. Field trip to beef, dairy, or hog feedlot. (3 hours)
10. Field trip to feed mill. (3 hours)
11. Study dentition of rabbit, rat, cat, dog, pig, man, sheep and cow using skulls and live specimens. Relate this to feeding habits. (3 hours)
12. Field trip to poultry farm or agricultural machinery distributor to study automated feeding. (3 hours)
13. Study of electron micrographs of typical mammalian cells. Familiarization with use of light microscope and study of cells (ex: liver) at three different magnifications. (3 hours)
14. Study of the stages of mitosis using whitefish blastulae and mammalian bone marrow cells. (6 hours)
15. Study of the stages of meiosis using squash preparations of grasshopper testes, sections of mammalian testes and sections of chicken ovaries. (6 hours)
16. Determination of student's own Rh phenotype and deducing student's probable genotype. (3 hours)
17. Determination of monohybrid and/or dihydbid inheritance of coat characteristics of F_1 mice produced from first laboratory exercise. (3 hours
18. Determination of phenotypic variation and distribution by studying kernels on ears of ornamental corn. (3 hours)
19. Demonstration and practice in the preparation of stained blood films and the identification of cellular components. (12 hours)
20. Variation in erythrocyte sedimentation rate in animals of different species. (3 hours)
21. Study of spermatogenesis from prepared slides. (3 hours)
22. Study of chicken and mouse embryos from live and preserved specimens. (6 hours)
23. Determine presence of parasites ova in feces of animals of different species. (3 hours)
24. Correlate data, analyze and draw conclusions from laboratory No. 1. (3 hours)
25. Correlate data, analyze and draw conclusions from laboratory No. 3. (3 hours)
26. Correlate data, analyze, and draw conclusions from laboratory No. 4. (3 hours)

Texts and References

Campbell and Lasley. *The Science of Animals That Serve Mankind.*

Catcott. *Animal Hospital Technology: A Text for Veterinary Aides.*

Coles. *Veterinary Clinical Pathology.*
Singleton. *Elementary Genetics.*
Squire. *Basic Pharmacology for Nurses.*
Sussman. *Growth and Development.*
Wallace and Srb. *Adaptation.*

Instructional Media

Association Films Inc., Broad at Elm, Ridgefield, New Jersey 07657
Search at Schering. 25 min., 16 mm., color, sound.

AVMA Film Library, 600 South Michigan Avenue, Chicago, Illinois 60605
The Veterinarian. 25 min., 16 mm., color, sound.

Department of the Army, Army Pictorial Center, 35-11 35th Avenue, Long Island City, New York 11106
Veterinary Service in the U.S. Army. 26 min., 16 mm., black and white, sound.

Radio-Motion Picture Bureau, State Department of Commerce, West Mall Plaza, Albany, New York 12206
Veterinarian, USDA. 28 1/2 min., 16 mm., color, sound.

Syracuse University, Film Rental Center, 1455 East Colvin Street, Syracuse, New York 13210
Egg into Animal. 12 min., 16 mm., color, sound.
Genetics: Chromosomes and Genes. 16 min., 16 mm., color, sound.
Genetics: Improving Plants and Animals. 14 min., 16 mm., color, sound.
Growth and Replacement. 28 min., 16 mm., color, sound.
Human Body: Nutrition and Metabolism. 14 min., 16 mm., color, sound.
Human Body: The Chemistry of Digestion. 16 min., 16 mm., color, sound.
Natural Selection and Adaptation. 28 min., 16 mm., color, sound.
Physical Environment. 11 min., 16 mm., color, sound.
Science of Genetics. 28 min., 16 mm., color, sound.

LABORATORY ANIMAL METHODS

Hours Per Week
Class, 3; Laboratory, 6

Course Description

Experimental methods and techniques employed with laboratory animals will be studied. Laboratory practice will be reinforced by lectures providing understanding of the mechanisms underlying the various procedures. Topics include collection and withdrawal of body fluids, infusion techniques, anesthesia and euthanasia as utilized in the research laboratory. Surgical techniques for the preparation of rodents for specialized study will include adrenalectomy, gonadectomies and hypophysectomy. Concepts and techniques of gnotobiotics will be applied to selected species. Methods of record keeping will be explored and practiced. Procedures and requirements essential to conformity with Animal Welfare Act and the various other federal guidelines will be emphasized.

Major Divisions

	Class Hours
I. Introduction to Laboratory Animal Technology	3
II. The Role of the Laboratory Animal Technician	2
III. Classification and Discussion of Laboratory Animals According to Microbiological Profile	3
IV. Basic Equipment Essential in the Breeding and Maintenance of Laboratory Animals	3
V. Axenic Techniques and Gnotobiology	15
VI. Design and Administration of Barrier Systems for Breeding and Research	4
VII. Utilization of Laboratory Animals for Biomedical and Veterinary Research	3
VIII. Practical Laboratory Animal Anatomy	3
IX. Tranquilization and Anesthesia in Laboratory Animals	4
X. Surgical Techniques in Laboratory Animals	3
XI. Recommended Euthanasia Techniques for Laboratory Animals	2
XII. Safety Procedures in the Animal Laboratory	3
Total	48

Units of Instruction

I. Introduction to Laboratory Animal Technology
- A. Historical aspects and evolution of laboratory animal research technology
  1. Early approaches (equipment and technology)
  2. Present day (procedures and facilities)
  3. Philosophical and ethical aspects of animal research
  4. Justification and contributions of laboratory animal research
- B. Legal requirements and regulatory standards relating to laboratory animal research
  1. Laboratory Animal Welfare Act (P.L. 89-544)
  2. State laws
  3. Local laws
  4. Institutional regulations
  5. ILAR standards for breeding, care and maintenance of laboratory animals
  6. Advisory organizations (ex: American Association of Accreditation of Laboratory Animal Care)

II. The Role of the Laboratory Animal Technician
- A. In a breeding colony operation
- B. As a laboratory animal services technician
- C. As a research laboratory technician

III. Classification and Discussion of Laboratory Animals According to Microbiological Profile
- A. Axenic (germfree)
- B. Gnotobiotic
- C. Gnotobiotic (customized intestinal flora)
- D. Specific pathogen free (maximum barrier)
- E. High grade conventional (medium barrier)
- F. Conventional

IV. Basic Equipment Essential in the Breeding and Maintenance of Laboratory Animals
- A. Caging, cage systems and ancillary equipment
  1. Basic requirements for effective caging
  2. Caging construction materials
  3. Types of caging and caging systems for various animal species
  4. Cage size and space requirements for ten common laboratory species (ILAR standards)
  5. Caging accessories
     a. Cage lids
     b. Food hoppers
     c. Watering equipment and systems
     d. Ancillary items (various)

B. Mechanical cage washing, sanitation and sterilization equipment
   1. Specifications for effective use
   2. Cage washers
      a. Tunnel-conveyor types
      b. Cabinet types
   3. Cage rack washers
   4. Bottle washers
   5. Autoclaves
      a. Various models (regular)
      b. High vacuum
      c. Gas (ethylene oxide) type

V. Axenic Techniques and Gnotobiology
   A. Introduction to gnotobiology
   B. Theory and philosophical aspects of germfree life
      1. Pure culture techniques
      2. Open and closed systems
      3. Technical and biological approaches
   C. Classification of gnotobiotic animals (by microflora profile)
   D. Germfree isolator equipment
      1. Physical barrier theory
      2. Germfree isolator development
         a. Stainless steel isolator (Reyniers unit)
         b. Flexible plastic isolator (Trexler)
            (1) Small rectangular units (2' to 6' lengths)
            (2) Jacket isolator
            (3) Surgical unit
            (4) Isolation unit (human)
            (5) Other design possibilities
         c. Rigid plastic isolator (plexiglass construction)

   E. Methods of sterilization of germfree supplies and equipment
      1. Autoclave (high vacuum type)
      2. Gas sterilization (ethylene oxide)
      3. Chemical sterilization with peracetic acid
      4. Dry heat utilizing a hot air oven
      5. Ultra filtration
      6. High energy electron beam (Van de Graaf accelerator)
      7. Germicidal ultra violet

   F. Derivation, maintenance and shipment of gnotobiotic animals
      1. Methods of derivation for germfree animals
         a. Cesarean surgical procedures
         b. Breeding germfree animals
      2. Rearing methods
         a. Foster suckling on lactating female
         b. Hand rearing techniques (various species)
      3. General characteristics of germfree animals
      4. Basic differences between gnotobiotic and conventional species
      5. Gnotobiotic isolator construction and maintenance
         a. Construction and sterilization of isolator
         b. Preparation of isolator after sterilization
         c. Processing and sterilization of supplies
         d. Entry of supplies
         e. Entry of animals
      6. Problems associated with gnotobiotic production
         a. Physical difficulties (cecal size)
         b. Nutritional (oversterilization of feed)
         c. Strain variations
         d. Absence of flora
         e. Reduced growth rate (same species)
         f. Brittle bones and other abnormalities
      7. Shipment of gnotobiotic animals
         a. Specialized equipment for self-contained operation
         b. Shipping isolators and protective covers
         c. Shipment by personal vehicle (truck or station wagon)
         d. Shipment by commercial carrier
   G. Histological, anatomical and biochemical profiles of gnotobiotic animals
      1. Histological
      2. Anatomical (gross)
      3. Biochemical
   H. Some immunological characteristics of gnotobiotic animals
      1. Globulins
      2. Immunological effects of ingestion of dead bacteria
      3. Resistance to x-ray exposure
      4. Non-specific resistance
      5. Role of microflora in certain diseases
   I. Determination of germfree status
      1. Microbiological quality control (general)
         a. Routine culture methods
         b. Supplemental media
         c. Tissue culture methods
         d. Gross microscopic methods
         e. Other detection techniques
      2. Detection methods including determination of various classes of contaminating organisms

J. Examples of gnotobiotic animals as research tools
   1. Microbiological investigations
   2. Nutritional investigations
   3. Human medicine
   4. Veterinary medicine

K. Outlook for the future in gnotobiotic research
   1. Gnotobiotic animals as research standards
   2. Space research
   3. Advantages in improving conventional animal qualities
   4. Other

VI. Design and Administration of Barrier Systems for Breeding and Research
   A. Philosophical considerations and justifications
   B. Maximum barrier (SPF) concept
      1. Recommendations for basic design and construction
         a. Fundamental designs and construction materials specifications
         b. Single species per room specification
         c. Equipment and supplies traffic flow pattern (clean and dirty concepts)
      2. Specifications for maximum barrier environmental systems
         a. Air conditioning
         b. Ventilation
         c. Ultra filtration
         d. Humidification-dehumidification
         e. Heat exchanges
         f. Temperature control
      3. Environmental requirements for ten common species of laboratory animals (according to ILAR standards)
         a. Recommended temperature
         b. Optimum humidity
         c. Recommended air changes per hour
      4. Special treatment (sanitation-sterilization of supplies and equipment
         a. Autoclave
         b. Steam chest
         c. Dip tank
      5. Operational requirements for an SPF facility
      6. Specialized training for SPF colony personnel
      7. Research and breeder usefulness, advantages and limitations of SPF quality animals
      8. Microbiological profile of SPF animals
      9. Continuous microbiological quality control testing programs

VII. Utilization of Laboratory Animals for Biomedical and Veterinary Research
   A. Product quality control
   B. Screening studies (drugs) (anti-carcinogenic compounds)
   C. Efficacy testing
   D. Toxicity studies
   E. Assay tests
   F. Surgical techniques
   G. Basic research
   H. Teaching

VIII. Practical Laboratory Animal Anatomy
   A. Skeletal system
   B. Muscular system
   C. Circulatory system
      1. Veins used in venipuncture
      2. Arteries used for determining pulse rates
   D. Thoracic and abdominal viscera
      1. Surgical sites
      2. Cardiac bleeding
      3. Injection sites
      4. Necropsy and tissue collection
   E. Reproductive system
      1. Pregnancy determination
      2. Semen collection
   F. Excretory system
   G. Nervous system
   H. Lymphatic system

IX. Tranquilization and Anesthesia in Laboratory Animals
   A. Tranquilizers
      1. Definition
      2. Use of tranquilizers
      3. General effects of tranquilizing drugs
      4. Activity of tranquilizers
      5. Action of tranquilizing drugs
         a. Autonomic suppressants
         b. Central nervous system relaxants
         c. Narcotics
      6. Toxicity of tranquilizers
      7. Chemical composition
      8. Contraindications of tranquilizing drugs
      9. Tranquilizers as preanesthetic medication
   B. Anesthetics
      1. Definition
      2. Planes of anesthesia
      3. Reflexes
      4. Examples and action in general (injectable) anesthetics
         a. Long acting

b. Short acting
5. Inhalant anesthetics
6. Examples and action of local anesthetics

C. Analeptics
1. Definition
2. Antagonists
a. Types used for barbiturates
b. Types used for morphine
3. Stimulants

D. Anticholinergics
E. Electro-anesthesia

X. Surgical Techniques in Laboratory Animals
A. Instruments and equipment
B. Surgical preparation of the animal
C. Preanesthetic medication
D. Anesthesia
E. Surgical approach
F. Ligation
G. Suturing technique
H. Post surgical care (nursing)

XI. Recommended Euthanasia Techniques for Laboratory Animals
A. Definition and general information
B. Selection of method and material
1. According to species
2. According to circumstances
a. Routine
b. Experimental animals

C. Methods of euthanasia[8]
1. Inhalant agents
a. Anesthetics
(1) Chloroform
(2) Ether
(3) Halothane
(4) Methoxyflurane
b. Carbon dioxide
c. Carbon monoxide
d. Methane gas
e. Hydrogen cyanide gas
2. Non-inhalant pharmacologic agents
a. Barbituric acid derivatives
b. Other injectable agents which are either undesirable as euthanasia agents or are recommended for limited species use
3. Physical methods
a. Electrocution
b. Rapid decompression
c. Decapitation (guillotine)
d. Pneumothorax
e. Heart rupture
f. Cervical fracture
g. Shooting
h. Captive volt pistol or other means of stunning
i. Rapid freezing in liquid air followed by decapitation

XII. Safety Procedures in the Animal Laboratory
A. Protective clothing
B. Inoculations
C. Reporting bites and injuries
D. First aid
E. Physical safety
F. Biological safety
G. Radiological safety
H. Personal hygiene
I. Safety procedures
J. Safety education

Suggested Laboratory Projects (96 hours)

1. Introduction to the Vivarium. (3 hours)
a. Tour of facilities (SPF and conventional)
b. Types of caging and ancillary equipment
c. Identification of animal species and strains
d. Cage washing and sanitation equipment

2. Introduction to Animal Laboratory Methods and initiation of Vivarial Practice projects. (3 hours)
a. Initiation of semester length, rodent breeding project in SPF facility (each student has complete responsibility for one breeding cage; including maintenance, breeding, record keeping and the collection of food-water consumption and growth rate data)
b. Indoctrination to and initiation of laboratory animal practice program; a semester length project in which each student is scheduled to participate in vivarial practice and supervision in both SPF and conventional areas of the breeding facility
c. Basic animal breeding colony maintenance and care techniques

3. Rodent dissection, anatomy review and necropsy procedures. (6 hours)
a. Anatomical review of injection sites
b. Review of general gross anatomy including viscera and lymphatics
c. Location and excising of endocrine glands - gland weight determination on analytical balance

[8]The euthanasia methods presented here parallel those discussed and recommended in the *Report of the A.V.M.A. Panel on Euthanasia* as reported in the March 1, 1972, issue of the Journal of the A.V.M.A. The reader is referred to the Bibliography section of this guide for a full reference to this article.

d. Necropsy techniques and removal of samples for microbiological and/or histopathological examination.

4. Introduction to methods and practice of laboratory animal injections. (9 hours)
   a. Indoctrination relating to identification, processing and use of various types and sizes of hypodermic needles and syringes
   b. Sterile techniques in removing fluids from sealed containers
   c. Identification of common injection sites
   d. Restraint and practice injections (IM, IV, SQ, IC, IP, ID) selectively in various laboratory animal species
      (1) Mice
      (2) Rats
      (3) Gerbils
      (4) Hamsters
      (5) Guinea pigs
      (6) Rabbits
      (7) Cats
      (8) Dogs

5. Intubation techniques and introduction to laboratory animal tranquilization and blood sampling. (9 hours)
   a. Intubation and forced feeding - medicating
      (1) Mice
      (2) Rats
      (3) Gerbils
      (4) Hamsters
   b. Tranquilization techniques relating to above listed species
      (1) Calculation of dosage
      (2) Administration
      (3) Observation of effects
   c. Practice blood sampling techniques (above listed species)

6. Practice of miscellaneous laboratory techniques. (9 hours)
   a. Practice tattooing - identification procedures
   b. Practice catheterization
   c. Ectromelia (mousepox) vaccination procedure
   d. Determination of estrus (cytological method)
   e. Pregnancy testing

7. Intubation, laboratory animal tranquilization and blood sampling techniques. (9 hours)
   a. Intubation and forced feeding - medicating
      (1) Guinea pigs
      (2) Rabbits
      (3) Cats
      (4) Dogs
   b. Tranquilization techniques relating to above listed species
      (1) Calculation of dosage
      (2) Administration
      (3) Observation of effects
   c. Practice blood sampling techniques (above listed species)

8. Introduction to small animal anesthesia. (6 hours)
   a. Preanesthetics
   b. Injectable anesthetics
      (1) Local
      (2) General
   c. Practice dosage calculation
   d. Administration of injectable anesthetics
   e. Identification of planes of anesthesia
   f. Reflexes
   g. Use of analeptics
   h. Inhalant anesthesia
      (1) Passage of endotracheal catheter
      (2) Anticholinergics

9. Basic rodent surgery procedures (completed by each student on an individual basis). (6 hours)
   a. Orientation, ethics and indoctrination of methods
   b. Surgical preparation (instruments - needles and sutures)
   c. Surgical (preoperative) preparation of animal
   d. Surgical procedure
      (1) Incision
      (2) Ligation and removal of organ
      (3) Suturing
      (4) Post-operative care

10. Endocrine surgery laboratory sequence. (9 hours)
    a. Completion of thyroidectomy technique on laboratory rats
    b. Ovariectomy technique completed on laboratory rats
    c. Adrenalectomy technique completed on laboratory rats

11. Introductory indoctrination and orientation relating to gnotobiotic isolator equipment and essential ancillary components. (3 hours)
    a. Identification of isolator types and component parts
    b. Operational information
    c. Methods of utilization of isolator equipment
    d. Processing supplies
       (1) Proper packaging of food and cage bedding material

(2) Packing supplies into sterilization cylinder
(3) Processing sterilization cylinder for autoclaving (placement and taping of mylar film)
(4) Preparation of water bottles (Square Pak Flasks) for autoclaving

12. Initiate construction of isolator sequence. (3 hours)
    a. Prepare isolator bases
    b. Locate and cut holes in isolator for gloves and door

13. a. Install gloves
    b. Install door brackets
    c. Install isolation door
    d. Attach isolator to base
    e. Process and sterilize vertical air filter
    f. Attach air outlet trap

14. Complete isolator construction sequence and prepare supplies. (3 hours)
    a. Attach vertical filter
    b. Attach air hose (filter air pump)
    c. Prepare Square Pak Flasks for autoclaving
    d. Prepare sterilization cylinders for autoclaving
    e. Method of preparing and dispensing peracetic acid

15. Sterilization techniques. (3 hours)
    a. High vacuum autoclave
        (1) Instruction in operational procedures
        (2) Sterilization of supply cylinders
        (3) Sterilization of water (Square Pak Flasks) without vacuum
    b. Assembling of isolator supplies for chemical (peracetic acid) sterilization
    c. Chemical sterilization - peracetic acid sterilization of plastic film isolator and isolator equipment fabricated of stainless steel, plastic, glass or rubber

16. Commence operational phase of sterilized isolator units. (3 hours)
    a. Start air system
    b. Process interior of isolator (set up)
    c. Enter supplies from sterilization cylinder
    d. Prepare isolator for entry of animals
    e. Practice (become familiar with) working with hands in isolator gloves
    f. Practice attachment (with plastic sleeve) between separate isolator units

17. Surgical (cesarean derivement) technique for populating functioning isolators with gnotobiotic mice. (3 hours)
    a. Cesarean surgery
    b. Introduction of surgically removed pregnant uterus into surgical isolator
    c. Removal of fetal mice from uterus
    d. Post removal techniques
    e. Transfer of derived animals into maintenance isolators

18. Operational and maintenance procedures in the care and handling of gnotobiotic mice in isolators. (3 hours)
    a. Routine procedures
        (1) Feeding, watering, cleaning, handling techniques
        (2) Entrance of supplies (pass-through techniques)
    b. Microbiological quality control of isolator equipment
        (1) Sampling methods
        (2) Sample removal from isolator
        (3) Processing of samples (using prescribed techniques) in the microbiology laboratory

19. Practice of routine experimental techniques utilizing animals housed in plastic isolator equipment. (3 hours)
    a. Intraorbital bleeding
    b. Injections (various sites) with saline solution
    c. Tail vein bleeding - preparation of blood smear slides for hematological examination
    d. Removal of gnotobiotic mice from isolator - comparison of internal anatomy (cecum - organs) with conventional mice

Texts and References

Animal Welfare Institute. *Basic Care of Experimental Animals.*
Arrington. *Introductory Laboratory Animal Science.*
Collins. *Manual for Laboratory Animal Technicians.*
Coates. *The Germ-Free Animal in Research.*
Conalty. *Husbandry of Laboratory Animals.*
Cotchin and others. *Pathology of Laboratory Rats and Mice.*
Croft. *An Introduction to the Anexthesia of Laboratory Animals.*
D'Amour and others. *Manual for Laboratory Work in Mammalian Physiology.*
Farris. *The Care and Breeding of Laboratory Animals.*
Farris and Griffith. *The Rat in Laboratory Investigation.*
Gay. *Methods of Animal Experimentation.*
Green. *Biology of the Labiratory Mouse.*
Harris. *The Problems of Laboratory Animal Diseases: Symposium.*
Institute of Laboratory Animal Resources. *Laboratory Animals.*
——. *Standards for the Breeding, Care and Management of: Mice, Rats, Guinea Pigs, Rabbits, Hamsters, Dogs, Cats and Monkeys.*

Lane-Petter. *Animals for Research.*
Luckey. *Germfree Life and Gnotobiology.*
Lumb. *Small Animal Anesthesia.*
National Institute of Health. *Guide for Laboratory Animal Facilities and Care.*
New York Academy of Sciences. *Germfree Vertebrates: Present Status.*
Notre Dame University. *Proceedings of the Second Symposium on Gnotobiotic Technology.*
Short and Woodnott. *The IAT Manual of Laboratory Animal Practice and Techniques.*
Smith. *Electrical Anesthesia.*
Teklad Incorporated. *Physiological Data for Common Laboratory Animals.*

Instructional Media

American Medical Association, Motion Picture Library, 535 North Dearborn Street, Chicago, Illinois 60610
Technic of Injection in Animals Part I. 12 min., 16 mm., color, silent.
Part II. 15 min., 16 mm., color, silent.

American Veterinary Medical Association, Film Library, 600 South Michigan Avenue, Chicago, Illinois 60605
So Life May Continue. 18 min., 16 mm., black and white, sound.

Audio-Visual Support Center (forward request to: Commanding General in the U.S. Army area in which the borrower resides).
Animals for Research. 28 min., 16 mm., color, sound.
Use of Germfree Animals in Research. 47 min., 16 mm., black and white, sound.

Encyclopedia Britannica Educational Corporation, 1822 Pickwick Avenue, Glenview, Illinois 60025
Endocrine Glands, 11 min., 16 mm., black and white, sound.

McGraw-Hill Book Company (Text Film Division) 327 West 41st Street, New York, New York 10036
Endocrine Glands - How They Affect You. 20 min., 16 mm., black and white sound.

National Medical Audiovisual Center (Annex), Station K, Atlanta, Georgia 30324
Germfree Animals in Medical Research. 19 min., 16 mm., color, sound.
Plastic Isolators: New Tools for Medical Research. 14 min., 16 mm., black and white, sound.

LABORATORY TECHNIQUES

Hours Per Week
Class, 3; Laboratory, 8

Course Description

A fundamental study in laboratory techniques, commonly known as clinical pathology which includes: hematology, blood coagulation, blood chemistry, liver function, renal function, pancreatic function, body fluid examination and parasitology.

Lecture periods involve the theory and application of diagnostic methods and principles as they apply in veterinary practice or the biomedical institution.

Laboratory exercises are dedicated to development of skills in the processing of tissue and specimen samples from patients. After an introduction to the test procedure, each student then performs and repeats this clinical test until proficiency is demonstrated.

Skill in the use of various items of laboratory equipment is acquired, including: microscopes, blood cell counting equipment, spectrophotometers, electronic particle counters, hemoglobin equipment, volumetric measuring equipment, and other items found in clinical and industrial laboratories.

Major Divisions

	Class Hours
I. Introduction to Hematology	1
II. Collection and Handling of Blood	2
III. Leukocytes	6
IV. Erythrocytes	6
V. Coagulation of Blood	1
VI. Blood Chemistry	4
VII. Liver Function	3
VIII. Kidney Function	6
IX. Pancreatic Function	2
X. Miscellaneous Examinations	4
XI. Parasitology	13
Total	48

Units of Instruction

I. Introduction to Hematology
- A. Functions of blood
- B. Blood examination
  1. Elements of complete blood count
  2. Other examinations of blood
- C. Basic purpose of hematology
  1. Diagnosis
  2. Prognosis
  3. Research

II. Collection and Handling of Blood
- A. Methods of collection
  1. Equipment
  2. Technique
  3. Anatomical sites for blood collection in various species
- B. Anticoagulants
  1. EDTA
  2. Oxalates
  3. Heparin
- C. Blood typing
- D. Blood banking

III. Leukocytes
- A. Indications and limitations
  1. Reasons for performing WBC counts
  2. Limitations in methods
- B. Methods of determination
  1. Total white cell count
  2. Correction factors
  3. Differential cell count
  4. Blood smear
  5. Staining methods
  6. Special preparations
- C. Leukocyte types and function
  1. General
  2. Neutrophil
  3. Eosinophil
  4. Basophil
  5. Lymphocyte
  6. Monocyte
- D. Species variation
  1. Canine
  2. Feline
  3. Bovine
  4. Equine
  5. Ovine
  6. Porcine
  7. Rabbit
  8. Guinea pig
  9. Hamster
  10. Mouse
  11. Rat
  12. Gerbil
  13. Rhesus monkey
  14. Human
- E. Interpretation of leukocyte count
  1. Factors influencing cell count

2. Leukocyte response in disease
3. Leukocytosis
4. Leukopenia
5. Toxic neutrophils
6. Prognostic value

F. Leukemia
1. General considerations
2. Classification of leukemic types

IV. Erythrocytes
A. General considerations
1. Composition
2. Size
3. Number per unit volume of blood
4. Function
5. Erythropoiesis
6. Erythrocyte fate
7. Hemolysis
8. Hemoglobin

B. Laboratory techniques for measuring erythrocyte values
1. Tests used
2. Limitations of tests used
3. Total red cell count
4. Electronic counting methods
5. Hemoglobin determination
6. Hematocrit determination
7. Mean corpuscular values
8. Erythrocyte sedimentation rate
9. Red cell morphology
a. Normal
b. Abnormal

C. Anemias
1. Definition
2. Classification

V. Coagulation of Blood
A. Clotting mechanism
1. Thromboplastic activity
2. Prothrombin conversion
3. Fibrinogen conversion
4. Clot dissolution
5. Anticoagulants

B. Abnormal coagulation
1. Lack of factors
2. Anaphylactic shock

C. Laboratory examinations
1. Coagulation time
2. Bleeding time
3. Blood platelets
4. Prothrombin test

VI. Blood Chemistry
A. Basic laboratory procedures
1. Preparation of solutions
2. Colorimetry

B. Plasma proteins
1. Identity and properties
2. Metabolism
3. Indications for determining plasma protein
4. Analytical procedures
5. Total serum proteins

C. Blood urea nitrogen
1. Indications for determination
2. Technique of BUN analysis

D. Electrolytes
1. Calcium
2. Phosphorus
3. Sodium
4. Potassium
5. Chloride
6. Magnesium

E. Cholesterol
1. Indications
2. Techniques

F. Blood glucose
1. Indications and limitations
2. Techniques
3. Glucose tolerance test

G. Enzymes
1. Alkaline phosphatase
2. Transaminases (SGOT, SGPT)
3. Lactic dehydrogenase (LOH)

VII. Liver Function
A. General considerations
1. Indications for liver function tests
2. Limitations of tests
3. Classification

B. Bile pigments
1. Normal physiology
2. Van den Bergh reaction (bilirubin)
3. Urinary urobilinogen
4. Fecal pigments

C. Liver function tests
1. Sulfobromophthalein (BSP)
2. Carbohydrate metabolism tests
3. Serum enzyme activity
4. Liver biopsy

VIII. Kidney Function
A. Methods of urine collection
B. Indications for urine testing
C. Urinalysis
1. Physical examination
a. Gross examination
b. Specific gravity
c. Other tests
2. Chemical examination

a. Reaction (pH)
b. Protein
c. Glucose
d. Ketones
e. Blood
f. Bile pigments
g. Indican
h. Chloride

3. Microscopic examination
a. Technique
b. Leukocytes
c. Erythrocytes
e. Epithelial cells
f. Casts
g. Other forms

D. Renal function tests
1. Dye excretion tests
2. Renal clearance tests

IX. Pancreatic Function
A. Indications for tests
B. Techniques
1. Microscopic
2. Fecal trypsin
3. Serum lipase
4. Serum amylase

C. Interpretation of tests
1. Acute necrosis
2. Chronic pancreatitis

X. Miscellaneous Examinations
A. Cerebrospinal fluid
1. Indications for analysis
2. Techniques for securing fluid
3. Examination

B. Vascular and tissue fluid losses
1. Exudates
2. Transudates
3. Cytodiagnosis

C. Synovial fluid
1. Porcessing of synovial fluid
2. Examination of synovial fluids

D. Genital fluids
1. Female - estrus cycle, fluid and cellular analysis
2. Male - spermatozoa analysis

E. Tissue collection
1. Materials
2. Preparation

XI. Parasitology
A. Fecal examination
1. Direct smear
2. Flotation
3. Sedimentation
4. Quantitative evaluation
5. Microfilaria examination

B. Ectoparasites
1. Mites
2. Lice
3. Ticks
4. Fleas
5. Larval and bot flies

C. Endoparasites
1. Protozoa
2. Arthropod borne parasites
3. Platyhelminths
4. Nematodes
5. Filaroidae

Suggested Laboratory Projects (128 hours)

1. Introduction to hematology laboratory and equipment. (2 hours)
2. Preparation of basic blood smears. (2 hours)
3. Preparation and counting of white blood cells, including differential cell count. (4 hours)
4. Hematocrit and sedimentation rate, preparation and reading. (2 hours)
5. Preparation and interpretation of blood hemoglobin determination, using various methods on comparative basis. (4 hours)
6. Identification of red blood cell abnormalities on prepared slides. (4 hours)
7. Clinical demonstrations of platelet counts and prothrombin times. (2 hours)
8. Clinical practice of above hematological methods on blood samples drawn by the student on all available species of animals. (12 hours)
9. Demonstration of clinical analysis of samples for various blood chemistry determinations. (8 hours)
10. Demonstration of liver function tests, students practice determining liver function values on species of animals available. (8 hours)
11. Analysis of physical, chemical and microscopic factors in urine of available animal species. (24 hours)
12. Analysis of pancreatic function in available species utilizing methods discussed in lecture. (8 hours)
13. Examination of cerebrospinal fluid, exudates, transudates, synovial fluid, sperm, and vaginal swabs on available animal species. (12 hours)
14. Collection of specimens for parasite identification. (4 hours)
15. Microscopic examination of feces for parasites. (24 hours)

16. External parasite identification from prepared samples and clinical cases. (6 hours)
17. Examination of miscellaneous parasites from prepared materials. (2 hours)

Texts and References

Benbrook and Sloss. *Veterinary Clinical Parasitology.*
Benjamin. *Outline of Veterinary Clinical Pathology.*
Bloom. *Urine of the Dog and Cat.*
Brooks. *Essentials of Medical Parasitology.*
Brown. *Basic Clinical Parasitology.*
Cameron. *Parasites of Domestic Animals.*
Chandler and Read. *Introduction to Parasitology.*
Coffin. *Manual of Veterinary Clinical Pathology.*
Coles. *Veterinary Clinical Pathology.*
Leavell and Thorup. *Fundamentals of Clinical Hematology.*
Merck and Company. *Merck Veterinary Manual.*
Schalm. *Veterinary Hematology.*
Seiverd. *Hematology for Medical Technologists.*
Soulsby. *Helminths, Arthropods and Protozoa of Domesticated Animals (Monnig).*
Whitlock. *Diagnosis of Veterinary Parasitisms.*
Wintrobe. *Clinical Hematology.*

Instructional Media

Alden Films, 5113 16th Avenue, Brooklyn, New York 11204
Ancylostoma: Life History of Hookworms. 25 min., 16 mm., color, sound.

American Medical Association, Motion Picture Library, 535 North Dearborn Street, Chicago, Illinois 60610
Ancylostoma Canium in the Intestine of the Dog. 5 min., 16 mm., black and white, sound.

American Society for Microbiology, 115 Huron View Boulevard, Ann Arbor, Michigan 48103
Dynamics of Phagocytosis. 25 min., 16 mm., black and white, sound.

American Veterinary Medical Association, Film Library, 600 South Michigan Avenue, Chicago, Illinois 60605
Bovine Parasitic Gastritis. 17 min., 16 mm., color, sound.
Psoroptic Sheep and Cattle Scabies. 12 min., 16 mm., color, sound.
Ticks and Tick-Borne Diseases. 19 min., 16 mm., color, sound.

Bell Telephone Company, New York, New York 10000
Hemo the Magnificant. 60 min., 16 mm., color, sound.

Churchill Films, 662 North Robertson Boulevard, Los Angeles, California 90069
Circulation, Why and How. 10 min., 16 mm., black and white, sound.

Encyclopedia Britannica Educational Corporation, Regional Office, 202 East 44th Street, New York New York 10017
Parasitism (Parasitic Flat Worms). (E.B. No. 2065) 16 min., 16 mm., color, sound.
Work of the Blood. 13 min., 16 mm., black and white, sound.

Extension Media Center, Distribution, University of California, Berkeley, California 94720
The World Within. 27 min., 16 mm., color, sound.

McGraw-Hill Book Company, 330 West 42nd Street, New York, New York 10036
White Blood Cells. 12 min., 16 mm., color, sound.

National Medical Audio-Visual Center (Annex), Atlanta, Georgia 30333
Anthropods of Public Health Importance. 7 min., 35 mm. film strip (42 frames), color, sound.

REGULATORY TECHNOLOGY I

Hours Per Week
Class, 3

Course Description

Regulatory Technology I is designed to acquaint the student with the national animal health programs of economic and human health significance, related authorities, regulations, policies; cooperating agencies, foreign animal diseases, and prevention of their introduction into the United States; monitoring the health of transit animals; enforcement of the Animal Welfare Act; and the role of the technician in support of Veterinary Medical Officers.

Major Divisions

	Class Hours
I. Historical Basis for Regulatory Animal Programs	2
II. Major Animal Disease Eradication Programs	14
III. Emergency Disease Programs	5
IV. Animal Welfare Programs	5
V. Interstate Regulations Enforcement	2
VI. Regulatory Aspects of Livestock Movement and Animal Identification	4
VII. Importation of Animals and Products	5
VIII. Exportation of Animals and Animal By-Products	5
IX. Civil Defense Responsibilities and Environmental Quality	2
X. Public Relations and Safety Practices	2
XI. Information Support	2
Total	48

Units of Instruction

I. Historical Basis for Regulatory Animal Health Programs
- A. Introduction
  1. Conditions leading to creation of Bureau of Animal Industry
  2. Legislation — authorities — policies
  3. How cooperative programs are developed
  4. U.S. Animal Health Association; Livestock Conservation, Inc.
  5. State-Federal cooperation
  6. Successful disease eradication programs
  7. Current disease eradication programs
  8. Economic losses from animal diseases and parasites
- B. Organization
  1. U.S. Department of Agriculture
  2. Animal and Plant Health Inspection Service
  3. Veterinary Services
  4. Local-State organizations
  5. Relationship to other governmental agencies

II. Major Animal Disease Eradiction Programs
- A. Cattle diseases
  1. Brucellosis
     a. Definition
     b. History of program
     c. Economic losses
     d. Human health significance
     e. Present program
  2. Tuberculosis
  3. Anaplasmosis
- B. Swine diseases
  1. Hog cholera
  2. Trichinosis
- C. Special diseases
  1. Cattle scabies
  2. Sheep scabies
  3. Scrapie in sheep and goats
  4. Bluetongue in sheep and cattle
  5. Tick eradiction
  6. Screw-worm eradiction
- D. Poultry diseases
  1. Salmonellosis
  2. Duck viral enteritis
  3. Avian mycoplasmosis
  4. Newcastle disease
- E. Equine diseases
  1. Equine piroplasmosis
  2. Equine infectious anemia
  3. Eastern-western equine encephalomyelitis
- F. Disease of several species of animals — anthrax

III. Emergency Diseases Programs
- A. State-Federal Emergency Disease Organization
  1. Responsibilities
  2. Organization
  3. Declaration of emergency
- B. Foreign animal diseases (exotic) of major economic importance

1. Foot-and-mouth disease
2. African swine fever
3. Rinderpest
4. Venezuelan equine encephalomyelitis
5. African horse sickness
6. Hog cholera
7. Newcastle disease

IV. Animal Welfare Programs
- A. Laboratory animal welfare
  1. Purpose of legislation
  2. Extent of coverage
  3. Standards
  4. Methods of enforcement
- B. Zoos, circuses, exhibitions
- C. Horse Protection Act

V. Interstate Regulation Enforcement
- A. Regulation compliance and disease eradication
  1. Promulgation of regulations
  2. Investigative procedures, affidavits, exhibits
  3. Code of Federal Regulations
  4. 28-Hour law
- B. Quarantine enforcement
  1. Premises quarantine
  2. State quarantine
  3. Federal quarantine

VI. Regulatory Aspects of Livestock Movement and Animal Identification
- A. Monitoring animals in transit
  1. Inspection and certification
  2. Release of healthy animals for movement
  3. Disposition of unhealthy animals
- B. Related inspection activities
  1. Receipt, identification, delivery of animals to commission companies
  2. Truck cleaning-disinfection, supervision-records
  3. Disposal of contaminated (infectious) cars
  4. Cattle patrols
  5. Dipping of sheep and cattle
  6. Identifying reactors and determining origin

VII. Importation of Animals and Products
- A. Applicable regulations
  1. Code of Federal Regulations, Part 92
  2. USDA memoranda
- B. Inspection of animals and animal by-products
  1. Determination of prohibited, restricted, or eligible for entry
  2. Certification

VIII. Exportation of Animals and Animal By-Products
- A. Applicable regulations
  1. Code of Federal Regulations, Part 91
  2. Memoranda
  3. Inspection procedures
- B. Inspection and certification of animals
  1. Requirements
  2. Inspection procedures
  3. Space
  4. Feed, water, care aboard vessel or aircraft

IX. Civil Defense Responsibilities and Environmental Quality
- A. USDA responsibilities
- B. Radiological monitoring instruments
- C. Effect of radiological fallout on man, animals and plants

X. Public Relations and Safety Practices
- A. Dealing with the public
  1. Legal authorities
  2. Methods of obtaining compliance
  3. Liability
- B. Safety practices
  1. On-the-job safety practices
  2. Handling pesticides and disinfectants

XI. Information Support
- A. State
- B. Federal
- C. Procedures

Texts and References

Cockburn. *Infections of Domestic Animals in the United States.*

Code of Federal Regulations. *Title 9 — Animal and Animal Products.*

Smith. *How U.S. Livestock are Protected from Foreign Diseases.*

United States Department of Agriculture. *Anthrax in Livestock.* (Program Aid No. 431)

——. *Contagious Pleuropneumonia.* (PA-769)

——. *Duck Virsus Enteritis.* (PA-925)

——. *Equine Infectious Anemia.* (PA-805)

——. *Eradicating Bovine TB.* (PA-641)

——. *Eradicating Cattle Scabies.* (PA-471)

——. *Eradicating Sheep Scabies.* (PA-458)

——. *The Fight Against Cattle Fever Ticks.* (PA-475)

——. *Foot-and-Mouth Disease.* (PA-600)

——. *Foot-and-Mouth Disease.* (ARS 91-58-1)

——. *Market Cattle Testing.* (PA-434)

——. *Minimum Program Standards for Hog Cholera Eradication.* (Memo No. 561.4)

——. *Questions and Answers — Screwworms.* (ARS 91-61-1)

———. *Regulatory Veterinary Medicine, Agriculture Handbook No. 167.*
———. *Rinderpest.* (PA-944)
———. *Stamping Out Hog Cholera.* (PA-928)
———. *Trichinosis Leaflet No. 428.*
———. *Uniform Methods and Rules for Brucellosis.*
———. *Uniform Methods and Rules for Tuberculosis.*

Instructional Media

Office of Information, Motion Picture Service, U.S. Department of Agriculture, Washington, D. C. 20250 (or from any of the cooperating State Film Libraries; for example, The New York State Film Library at Radio-Motion Picture Bureau, State Department of Commerce, West Mall Plaza, Albany, New York 12206).

African Horse Sickness. 28-1/2 min., 16 mm., color, sound.
Among Your Souvenirs. 13-1/2 min., 16 mm., color, sound.
Back the Attack on Brucellosis. 27-1/2 min., 16 mm., color, sound.
Blue Tongue. 9 min., 16 mm., color, sound.
Bovine Contagious Pleuropneumonia. 28 min., 16 mm., color, sound.
Brucellosis Ring Test. 5-3/4 min., 16 mm., color, sound.
Conquest of Sheep Scabies. 13-1/2 min., 16 mm., color, sound.
Do Unto Animals. 21 min., 16 mm., black and white, sound.
Epidemic Foot-and-Mouth Disease in Canada. 16 min., 16 mm., color, sound.
Equine Infectious Anemia (EIA). 16-1/4 min., 16 mm., color, sound.
Fallout and Agriculture. 22-3/4 min., 16 mm., color, sound.
Handling Livestock Safely. 9-3/4 min., 16 mm., color, sound.
Hog Cholera — African Swine Fever, A Comparison. 23 min., 16 mm., color, sound.
Psoroptic Sheep and Cattle Scabies. 12 min., 16 mm., color, sound.
Radiation Effects on Farm Animals. 13 min., 16 mm., color, sound.
Rinderpest. 18 min., 16 mm., color, sound.
Roundup (Screwworm). 18-1/4 min., 16 mm., color, sound.
Safe Use of Pesticides. 21-1/2 min., 16 mm., color, sound.
Scrapie. 8 min., 16 mm., color, sound.
Sign of Profit. 20 min., 16 mm., color, sound.
Stamp Out Hog Cholera. 21-1/2 min., 16 mm., color, sound.
Threat of the Cattle Fever Tick. 14-1/2 min., 16 mm., color, sound.
Traceback. 13 min., 16 mm., color, sound.
Triple Threat of Brucellosis. 27 min., 16 mm., color, sound.
Vesicular Exanthema. 17 min., 16 mm., color, sound.
Vicious Circle (Tuberculosis). 21 min., 16 mm., color, sound.

REGULATORY TECHNOLOGY II

Hours Per Week
Class, 3; Laboratory, 6

Course Description

This course in regulatory technical procedures includes the collection and submission of blood and milk samples for laboratory diagnostic tests, of ectoparasites (ticks — mites) as demonstrated in Figure 10; animal identification procedures, appraisal of reactors to tests, supervision of premises cleaning and disinfection; preparation, use, disposal of pesticides; investigations of animal quarantine law violations; inspection of animal products offered for importation into the United States; use of slaughter samples in programs, tracing of infected and exposed animals; and inspection of laboratory animal dealer premises. Laboratory sessions provide practical application of principles emphasized in lectures. Field trips will be utilized where operations and facilities are available to demonstrate and provide practical experience.

Figure 10 — As demonstrated here, regulatory technicians are responsible for the collection of external parasites infesting beef cattle and other species. The technician must be capable of identifying the parasites collected or know how to properly submit the specimens to a diagnostic laboratory.

Major Divisions

	Class Hours
I. Brucellosis Testing Procedures	5
II. Market Cattle and Swine Identification	4
III. Cleaning and Disinfection	3
IV. Ectoparasites — Collection; Submission	4
V. Sheep and Cattle Scabies, and Tick Eradication; Screwworm Eradication	6
VI. Equine Diseases	4
VII. Swine Diseases — Program Procedures	4
VIII. Regulations Compliance Procedures and Public Stockyard Inspection	4
IX. Importation of Animal Products — Inspection Procedures	4
X. Animal Welfare Inspection Programs	4
XI. Emergency Programs	4
XII. Poultry Diseases	2
Total	48

Units of Instruction

I. Brucellosis Testing Procedures
- A. Introduction
  1. Purpose of sample collection
  2. Area certification and validation
  3. State-Federal officials, practitioners, livestock owners
- B. Collection of blood samples
  1. Locating herds, premises, farms
  2. Restraint of animals, chute operation, tagging and branding
  3. Equipment required and use of equipment
  4. Safety precautions, sanitary practices
  5. Test charts, care and submission of samples

II. Market Cattle and Swine Identification
- A. Orientation
  1. Purpose of program
  2. Importance of program
  3. Application of program to Brucellosis, Tuberculosis eradication programs
- B. Operation of market cattle and market swine identification
  1. Identification system
  2. Tracing animal from slaughter to farm of origin
  3. Testing of reactor herds
  4. Documentation, records, reports

III. Cleaning and Disinfection
  A. Introduction
    1. How disinfectants work
    2. Approved disinfectants
  B. Application of disinfectants
    1. Selecting proper disinfectant
    2. Preparing solution
    3. Cleaning premises — application of disinfectant
    4. Selection of equipment — proper use of equipment
    5. Safety practices, disposal of disinfectant

IV. Ectoparasites — Collection; Submission
  A. Introduction
    1. Eradication program
    2. Host ranges
    3. Transmission
  B. Submission of mites, ticks
    1. Collection of mites and ticks
    2. Prepare slide with mite specimens
    3. Laboratory submission of mites and ticks
    4. Maceration-flotation technique
    5. Documentation — reports
  C. Submission of screwworm larvae
    1. Collection
    2. Prepare for laboratory submission
    3. Documentation — reports

V. Sheep and Cattle Scabies, and Tick Eradication; Screwworm Eradication
  A. Introduction to scabies and tick programs
    1. State-Federal cooperative programs
    2. Economic losses from scabies and ticks
    3. Signs and symptoms of scabies and tick infestations
    4. Tracing procedures
    5. Documentation, report forms
  B. Dipping operation
    1. Owner contacts
    2. Quarantines
    3. Equipment required
    4. Protective clothing
    5. Selecting proper pesticide, formulation of dip
    6. Handling livestock and dipping operation
    7. Disposal of pesticides, safety practices
    8. Operating spray-dip machines
    9. Dipping vat management
  C. Screwworm eradication
    1. Eradication program
    2. Economic losses from screwworms
    3. Screwworm plant operation
    4. Dispersal of screwworm flies

VI. Equine Diseases
  A. Introduction
    1. Equine piroplasmosis or horse tick fever
      a. Program guidelines
      b. Tick collection
      c. Spraying infested horses with pesticide
      d. Report of inspections
    2. Equine infectious anemia
      a. History
      b. Economic losses
      c. Diagnostic tests

VII. Swine Diseases — Program Procedures
  A. Introduction
    1. Guidelines for national hog cholera eradication program
    2. Guidelines for national trichinosis eradication program
  B. Program procedures — hog cholera
    1. Regulation application to garbage fed swine
      a. Sanitation
      b. Cooking equipment, time, temperature
      c. Health inspection of swine
    2. Field operations — hog cholera
      a. Depopulation of infected herds
      b. Appraisal, disposal of swine, safety practices
      c. Cleaning and disinfection of premises
      d. Placing quarantines on premises, swine movements
    3. Market supervision
    4. Quarantine supervision

VIII. Regulations Compliance Procedures and Public Stockyard Inspection
  A. Introduction
    1. Applicable laws, regulations, policies
    2. Relation of regulation compliance to successful eradication programs
  B. Regulation compliance procedures
    1. Code of Federal Regulations
    2. Chapters of CFR relating to special programs
  C. Role of compliance officer
    1. Handling apparent violations, obtaining data from truckers, shippers, owners

2. Obtaining affidavits — proper format
3. Documentation, reports, records, exhibits
4. Jurisprudence

IX. Importation of Animal Products — Inspection Procedures
A. Introduction
1. Criteria for inspection of animal products
2. Diseases transmitted by animal products
3. Related federal agencies, customs, public health, immigration, animal quarantine inspection
4. Receiving and disposition of restricted products
5. Importation of animal by-products, hay and straw

B. Inspection procedures
1. Sea stores, meats, animal by-products, ship garbage
2. Meats: cooked, cured, fresh frozen, chilled
3. Inspection of hides, casings, disinfection
4. Baggage inspection
5. Inspection of other animal products

X. Animal Welfare Inspection Programs
A. Animal Welfare Act — Public Law 89-544
1. Purpose of Animal Welfare Act
2. Animal species covered by Act
3. Standard for humane care of animals
4. Technician's duties under the Act
B. Animal Welfare Act — Public Law 91-579
1. Zoos, circuses, exhibitions
2. Inspection and inspection procedures
3. Documentation
4. Animal species covered by Act
5. Violations of standards
C. Horse Protection Act — Public Law 91-540
1. Purpose of Act
2. "Soring" defined
3. Penalties for non-compliance with regulation
4. Documentation
5. Technician duties under the Act

XI. Emergency Programs
A. Introduction
1. Emergency disease organization defined
2. Duties and responsibilities of members
3. Foreign animal diseases of major economic importance
B. Operations
1. Information
2. Investigations
3. Quarantine, cleaning, and disinfection
4. Appraisals, disposals
5. Movement of animals and products

XII. Poultry Diseases
A. Introduction
1. Poultry marketing practices
2. Hatchery sanitation
3. Broiler production and SPF concept
4. Layer flocks
5. Turkey production
6. Duck production
B. Laboratory projects
1. Hatchery inspection
2. Air sampling
3. Feed sampling for contamination
4. Bleeding fowl for blood tests
5. Tracing hatching eggs, baby chicks, started poultry movement

Suggested Laboratory Projects (96 hours)

1. Review restraint of cattle, horses, sheep, and poultry, and use of cattle chute. Collection of blood samples from animals, identification of animals, record eartags on test chart, prepare samples for laboratory shipment. (6 hours)
2. Set up blood serum and conduct Brucellosis agglutination tests, perform white blood cell counts for Cholera, record results on test charts. (6 hours)
3. Collect milk samples and conduct Brucellosis Ring Test, interpret and record results. (6 hours)
4. Appraise, tag, and brand Brucellosis and Tuberculosis reactor cattle and swine, complete documents and shipping permit. (4 hours)
5. Study market cattle and swine identification, identification tag application and tattoo. Visit markets and slaughter plant to observe sample collection. (8 hours)
6. Assist in cleaning and disinfection of premises, prepare and apply disinfectant. (6 hours)
7. Examine and identify several species of ticks and mites and screwworm larvae; mount mites on glass slide, prepare mites, ticks, and screwworm larvae for submission to laboratory. (8 hours)

8. Prepare pesticide solution, dip sheep and cattle for mites, collect dip samples, dispose of pesticide, operate spray-dip machines, observe safety precautions. (6 hours)
9. Inspect a swine garbage feeding facility and observe health of swine sanitation, cookin equipment, time and temperature. (8 hours)
10. Prepare affidavits for apparent violation of animal quarantine laws, complete report forms, documentation. (4 hours)
11. Investigate and check waybills for violation of 28-Hour Law, prepare documents for violation, inspect feed, water, and rest station. (4 hours)
12. Inspect animal by-products offered for importation, determine if restricted, prohibited or eligible for entry; inspect ships, flights, for prohibited animal by-products, inspect baggage for prohibited animal by-products. (6 hours)
13. Inspect laboratory animal dealer premises for compliance with standards for humane treatment, document report of inspection, and assist veterinarian while inspecting horses for soring. (8 hours)
14. Study the responsibilities of technician's role in the emergency disease organization; operate radiological monitoring instruments, implement enthanasia and disposal operations. (4 hours)
15. Visit a State-Federal diagnostic laboratory, State and Federal regulatory offices and discuss animal health programs. (8 hours)
16. Visit a hatchery and observe and assist in sampling procedures, and bleeding of fowl for tests. (4 hours)

Texts and References

Texts and references cited for use in Regulatory Technology I are also applicable for Regulatory Technology II instruction. Regulations, memoranda, manuals, pamphlets, and protocols related to cooperative animal health programs or Federal-State responsibilities are available from the Federal and State animal health officials located in the State Capital, in most instances. These officials should be contacted to provide guidance and to recommend current reference material related to the regulatory technology curriculum.

Instructional Media

Fims, filmstrips and 35 mm. slide sets applicable to the regulatory technology curriculum are located in the Office of the Veterinarian in Charge, Veterinary Services. Animal and Plant Health Inspection Service (APHIS), USDA in the State Capitals. Information pertaining to reference materials and visual aids may also be obtained from The Deputy Administrator, Veterinary Services, APHIS, USDA, Washington, D. C. 20250. See Regulatory Technology I course outline for a listing of suggested films through these sources.

ANIMAL NUTRITION

Hours Per Week
Class, 3

Course Description

An introductory course which presents the basic principles of nutrition applicable to all classes of domestic and research animals. The essential nutrients are covered in detail and their synthesis and metabolism explored. Types, combinations, and preparation of feedstuffs as they relate to various animal diets, are investigated. Methods for the evaluation of commercially available rations are also discussed. The metabolic role of, economic importance and governmental controls applicable to the use of feed additives are also pursued.

Major Divisions

	Class Hours
I. Introduction	5
II. Essential Nutrients	10
III. Physiology of Nutrition	5
IV. Bioenergetics	4
V. Feedstuffs	20
VI. Feed Additives	4
Total	48

Units of Instruction

I. Introduction
- A. The general basis of nutrition
- B. Composition of the animal body
  1. Minerals
  2. Blood
  3. Muscle and other tissues
  4. Gross body composition
- C. Composition of plants and their products
  1. Leafy plants
  2. Seeds
  3. Roots

II. Essential Nutrients
- A. Water
  1. Metabolic water
  2. Water requirements of animal species
- B. Carbohydrates
  1. Chemistry of carbohydrates
  2. Determination of carbohydrates for nutritional purposes
  3. Carbohydrate metabolism
- C. Lipids
  1. Body fats
  2. The fatty acids
  3. Lipid metabolism
  4. Fat depositions
  5. Ketosis
- D. Proteins
  1. Composition
  2. Essential and non-essential amino acids
  3. Protein quality
  4. Protein metabolism
  5. Minimum and optimum protein intake
- E. Inorganic elements
  1. Essential minerals
  2. General function of mineral elements
  3. Calcium and phosphorus metabolism
     a. Composition of bone
     b. Absorption of calcium and phosphorus
  4. Iron, sodium, potasium and chlorine requirements and metabolism
  5. Iodine requirements and deficiency symptoms
  6. Chelated and trace minerals
- F. The vitamins
  1. Action of vitamins in body metabolism
  2. Fat soluble vitamins
  3. Water soluble vitamins

III. Physiology of Nutrition
- A. Digestion
  1. Ruminant
  2. Non-ruminant
- B. Absorption
- C. Conversion of food into body elements

IV. Bioenergetics
- A. Total digestible nutrients
- B. Digestible energy
- C. Metabolizable energy
- D. Net energy

V. Feedstuffs
- A. Pastures
- B. Hay and silages
- C. Legumes and cereal grains
- D. Preparation of feedstuffs

1. Grinding
2. Cooking
3. Cracking
4. Pelleting

E. Useful combinations of ingredients
1. Small animal diets
2. Large animal diets
3. Examples of complete diets for specific species

F. Evaluation of normal rations (commercial)
1. Total digestible nutrients
2. Protein
3. Fat
4. Ash
5. Vitamins
6. Minerals

VII. Feed Additives
A. Hormones
B. Antibiotics
C. Prophylactics (example: anthelminthics)
D. Iodinated casein
E. Thyroxine and thiouracil

Texts and References

Arrington. *Introductory Laboratory Animal Science.*

Crampton and Harris. *Applied Animal Nutrition: The Uses of Feedstuffs in the Formulation of Livestock Rations.*

Crampton and Lloyd. *Fundamentals of Nutrition.*

Jennings. *Feeding, Digestion and Assimilation in Animals.*

Maynard and Loosli. *Animal Nutrition.*

Morrison. *Feeds and Feeding.*

Worden and Lane-Petter. *The UFAW Handbook on the Care and Management of Laboratory Animals.*

Instructional Media

American Cynamid Company, Davis and Geck Division, Film Library, 1 Casper Street, Danbury, Connecticut 06810

Vitamins and Some Deficiency Diseases. 35 min., 16 mm., color, sound.

Encyclopedia Britannica Films, Inc., 1150 Wilmette Avenue, Wilmette, Illinois 60091

Foods and Nutrition. 11 min., 16 mm., black and white, sound.

Fundamentals of Diet. 11 min., 16 mm., black and white, sound.

Michigan State University, Instructional Media Center, East Lansing, Michigan 48823

Foods and Nutrition. 11 min., 16 mm., black and white, sound.

Syracuse University, Film Rental Center, 1455 East Colvin Street, Syracuse, New York 13210

Energy Relations (AIBS). 28 min., 16 mm., color, sound.

Understanding Vitamins. 14 min., 16 mm., color, sound.

TECHNICAL REPORTING

Hours Per Week
Class, 2

Course Description

This course is designed as a specialized extension of Communication Skills. It utilizes the basic background previously acquired to develop capabilities in the areas of technical report preparation and verbal communication within group situations.

The comprehensive approach employed in achieving the objectives of this course includes reading and evaluation of selected articles of technical literature, indoctrination and practice relating to library usage and data retrieval, as well as extensive practice both in writing and verbal presentation of technical data.

The use of graphs, charts, sketches, diagrams, drawings and projectable items is encouraged in achieving maximum clarity and effectiveness in the preparation and/or presentation of technical reports. The scope of this course makes possible communication practice exercises (both written and verbal) in a variety of different technical areas within the veterinary science technology curriculum.

Major Divisions

	Class Hours
I. Introduction to Technical Reporting ..	3
II. Elements of Technical Writing	4
III. Organizing the Technical Paper	2
IV. Writing of Technical Reports	11
V. Illustrating Technical Reports	4
VI. Review and Evaluation of Technical Literature	4
VII. Oral Presentation of Technical Literature	2
VIII. Group Communication and Participation	2
Total	32

Units of Instruction

I. Introduction to Technical Reporting
- A. Justification of the field of technical writing
- B. Application of technical communication to the bio-medical and veterinary fields
- C. Historical review of data retrieval methods and technical reporting

II. Elements of Technical Writing
- A. Responsibilities of the technical writer
- B. Selection of technical style
- C. Factors which contribute to effective writing
  1. Concise language
  2. Word usage
  3. Spelling
  4. Punctuation
  5. Compound words and derivatives
  6. Numerals
  7. Preparation of copy
- D. Familiarization with technical reports (distribution of selected copies to class for positive and/or negative evaluation)

III. Organizing the Technical Paper
- A. Subject and purpose
- B. Source materials
  1. Bibliographical tools
  2. Periodical indexes
  3. The library
- C. Organizing the paper
  1. A working bibliography
  2. Notes and the outline
  3. The rough draft
  4. Quoting and footnoting
  5. The final paper

IV. Writing of Technical Reports
- A. General considerations
- B. Collection of raw data through preparation of information (abstract) cards
- C. Structure of the report
  1. Preparation of the *Title Page*
  2. Preparation of the *Abstract* for a technical report
  3. Preparation of the *Introduction* section
     a. Literature survey
     b. Citing references
  4. Preparation of the *Materials And Methods* section
  5. Preparation of the *Results* section
  6. Preparation of the *Discussion* section
  7. Preparation of the *Summary-Conclusion* section
  8. Preparation of the *Bibliography* section
     a. General bibliography format
     b. Method for citing technical reports
     c. Method for citing reference books

9. Preparation and use of the *Appendix* section

V. Illustrating Technical Reports
   A. Illustrations as aids to brevity and clarity
   B. Use of technical sketching and drawings
   C. Use of pictorial drawings and sketches
   D. Use of a diagrammatic representation
      1. Electrical diagrams and symbols
      2. Process flow diagrams
      3. Instrumentation diagrams
      4. Bar charts, pie diagrams, and similar presentation of data
   E. Graphical presentation of data
      1. Types of graph paper
      2. Choice of scale for graphs
      3. Points and lines
      4. Use of data from graphs
   F. Use of photographs
   G. Selection of appropriate illustrations
      1. Availability
      2. Cost of preparation
      3. Maximum brevity and clarity of presentation

VI. Review and Evaluation of Technical Literature
   A. Reading of selected bio-medical or veterinary oriented papers and reports
   B. Critical review and evaluation of individual sections of assigned reading.

VII. Oral Presentation of Technical Literature
   A. Preparation of the oral report
      1. Organization of materials to be presented
      2. Time allotment
      3. Method of delivery
      4. Audio-visual supplementation (films, slides)
   B. Recommendations for speaking in public (before a professional group)
   C. Importance of personal appearance
   D. General considerations
   E. Responses during question and answer session at conclusion of oral presentation

VIII. Group Communication and Participation
   A. The problem-solving approach
      1. Stating and analyzing the problem
      2. Proposing solutions
      3. Selecting and implementing a solution
   B. Participating in group communication
      1. The chairman — duties and qualifications
      2. Rules of order
      3. The panel discussion and symposium
      4. Group investigation

Texts and References

American Institute of Biological Sciences. *Style Manual for* Biological Journals.
Brown. *Casebook for Technical Writers.*
Corbin and Perrin. *Guide to Modern English.*
Crispin. *Dictionary of Technical Terms.*
Crouch and Zetler. *A Guide to Technical Writing.*
Dean and Bryson. *Effective Communication.*
Estrin. *Technical and Professional Writing: A Practical Anthology.*
Fowler. *A Dictionary of Modern English Usage.*
Hays. *Principles of Technical Writing.*
Luzadder. *Graphics for Engineers.*
Menzel and others. *Writing a Technical Paper.*
Nicholson. *A Dictionary of American-English Usage.*
Schutte and Steinberg. *Communication in Business and Industry.*
Sherman. *Modern Technical Writing.*
Sigband. *Effective Report Writing.*
Souther. *Technical Report Writing.*
Strunk. *The Elements of Style.*

Instructional Media

Armed Forces Institute of Pathology, Walter Reed Army Medical Center, Washington, D. C. 20305
Oral Presentation of Scientific Data. 44 min., 16 mm., black and white, sound.
The Use of Medical Literature. 53 min., 16 mm., black and white, sound.

National Medical Audiovisual Center (Annex), Atlanta, Georgia 30333
Medlars. 35 min., 16 mm., black and white, sound.

APPLIED MATHEMATICS

Hours Per Week
Class, 3

Course Description

An introductory course designed to provide the basic concepts and principles of mathematics that relate to the technical courses in this curriculum. Fundamental concepts relating to real number systems, properties of numbers, laws of exponents, linear equations, application of algebraic techniques to solution of work problems, will be established. An introduction to the nature and use of statistical tools will enable the student to evaluate the kinds of numberical data encountered in the veterinary science technology field. The final unit on economics is included because of its universal application and value to all students.

Major Divisions

	Class Hours
I. Basic Mathematical Concepts and Operations	3
II. Basic Geometric Figures and Units of Measure	4
III. Basic Algebraic Fundamentals	10
IV. Probability	2
V. Statistics	16
VI. Functions and Graphs	4
VII. Logarithms	4
VIII. Mathematics of Investment	5
Total	48

Units of Instruction

I. Basic Mathematical Concepts and Operations
- A. The integers — positive, negative, and zero
- B. Whole numbers, fractions, and literal numbers
- C. The four fundamental operations
- D. Operations involving exponents
- E. Roots of numbers
  1. Squares and square root
  2. Cube and nth root
- F. Decimals and percentage
- G. Data Processing
  1. Concept of electronic business data processing
  2. Applications to veterinary science technology

II. Basic Geometric Figures and Units of Measure
- A. Systems of measurement
  1. English
  2. Metric
- B. Linear and square measurement
  1. Triangles
  2. Rectangles
  3. Perimeter
  4. Trapezoids
  5. Circles
  6. Irregular areas
- C. Units of area measurement
- D. Volume measurement
  1. Solids
  2. Liquids
- E. Units of volume measurement
- F. Density of solids and liquids

III. Basic Algebraic Fundamentals
- A. Laws of algebra
- B. Basic laws of operating on literal numbers
  1. Terms, monomials, binomials, and polynomials
  2. Factoring algebriac expressions
  3. Equations and formulas
  4. Operations on equations
  5. Operations with and simplifying radicals
- C. Linear equations and their solutions
  1. Solutions of systems of two linear equations
     a. Graphical
     b. Algebriac
  2. Solution of systems of three linear equations in three unknowns
- D. Quadratic equations and their solution
  1. By factoring
  2. By completing the square
  3. By quadratic formula
- E. Rational algebraic expressions
  1. Fundamental principles
  2. Lowest common denominator and multiple
  3. Ratio

4. Proportion
5. Mixtures and dilutions

IV. Probability
- A. Independence of sets
- B. Set and its complement
- C. Binominal distribution

V. Statistics
- A. Descriptive methods for ungrouped and grouped data
  1. Mean
  2. Median
  3. Mode
  4. Standard deviation
  5. Frequency polygon
  6. Histogram and bar-graph
  7. Normal distribution
  8. Standard scores
  9. Percentiles
- B. Inferential methods
  1. Confidence intervals, error
  2. Null and alternate hypotheses, one and two tailed testing
  3. Student's t-distribution
  4. Predicting population from sample testing, use sample means or proportions
  5. Comparing two samples using sample means or proportions
  6. Linear correlation, regression, and ranking

VI. Functions and Graphs
- A. Functions
- B. Rectangular coordinates
- C. Graphs of functions

VII. Logarithms
- A. Exponential and logarithmic functions
- B. Graphs of $y=b^x$ and $y=\log b^x$
- C. Properties of logarithms
- D. Common logarithms
- E. Reading logarithm tables and interpolation
- F. Computations using logarithms

VIII. Mathematics of Investment
- A. Principal and interest
  1. Simple interest
  2. Compound interest
- B. Mortgages
- C. Installment buying
- D. Loans
- E. Profit and loss
- F. Taxes
- G. Discount
- H. Commmission or brokerage

Texts and References

Addison-Wesley. *Statistics by Example.*
Hoel. *Elementary Statistics.*
Mendenhall and Ott. *Understanding Statistics.*
Naiman and others. *Understanding Statistics.*
Tuites. *Basic Mathematics for Technical Courses.*
Washington. *Basic Technical Mathematics.*
Zuwaylif. *General Applied Statistics.*

Instructional Media

Michigan State University, Instructional Media Center, East Lansing, Michigan 48823

Algebra: Relations, Functions and Variations. 11 min., 16 mm., black and white, sound.

Analog Computer. 28 min., 16 mm., black and white, sound.

Geometry: Inductive and Deductive Reasoning. 13 min., 16 mm., color, sound.

Mean, Median, Mode. 13 min., 16 mm., color, sound.

Probability. 12 min., 16 mm., color, sound.

APPLIED CHEMISTRY

Hours Per Week
Class, 3; Laboratory, 3

Course Description

This course reviews general inorganic chemistry. It also introduces organic and biological chemistry as applied to the veterinary science technology field.

The laboratory exercises have been chosen to provide basic skills in handling equipment and chemicals, and to provide applications of chemical principles to this field. The experiments performed are intended to enhance material presented in lecture. The student is introduced to objective observation, accurate note taking and reporting, and safety practices in handling chemicals and equipment. Visual and other instructional aids are employed to vary the approach to subject matter and provide stimulation throughout the course.

Major Divisions

	Class Hours
I. Review of the Metric System	2
II. Chemical Symbols and the Elements	3
III. Chemical Bonds and Valence	4
IV. Physical and Chemical Properties	3
V. Solutions	3
VI. Ionization	5
VII. Chemical Reactions	4
VIII. Colloids	3
IX. Basic Organic Compounds	5
X. Carbohydrates	3
XI. Lipids	2
XII. Amino Acids and Proteins	4
XIII. Nucleo-Proteins	2
XIV. Enzymes	3
XV. Hormones	1
Total	48

Units of Instruction

I. Review of the Metric System
- A. Decimal System
- B. Exponents
- C. Units of length
- D. Volume and weight relationships, and units
- E. The temperature scales

II. Chemical Symbols and the Elements
- A. Atomic structure and particles
- B. Radio-active isotopes
- C. Atomic number and weights
- D. Compounds
  1. Law of definite proportion
  2. Formula and formula weights
  3. Percent composition

III. Chemical Bonds and Valence
- A. Ionic bonds
- B. Covalent bonds
- C. Hydrogen bonds
- D. Valence theory

IV. Physical and Chemical Properties
- A. Physical and chemical changes
- B. Heat of solution
- C. Heat of reaction
- D. Particle size and solubility

V. Solutions
- A. Definition and components of a solution
- B. Percentage solution
- C. Saturated and supersaturated solutions
- D. Molar and normal solutions
- E. Dilutions

VI. Ionization
- A. Ionization of water; the pH scale
- B. Measurement of pH
- C. Acids, bases, and salts
- D. Common ions
- E. Water hardness, distilled water

VII. Chemical Reactions
- A. Reaction kinetics
- B. Equilibrium
- C. Neutralization reactions
- D. Oxidation-reduction
- E. Reactions of acids, bases, and salts

VIII. Colloids
- A. Particle size and surface activity
- B. Suspensions and emulsions
- C. Modified suspensions and emulsions
- D. Emulsifying agents
- E. Dialysis and precipitation of colloids

IX. Basic Organic Compounds
- A. The carbon atom
- B. Aliphatic and aromatic hydrocarbons
- C. Organic functional groups
  1. Organic halogen compounds

2. Alcohols and ethers
3. Acids, aldehydes, and ketones
4. Amides and amines

D. Organic reaction

X. Carbohydrates
- A. Structure and nomenclature of carbohydrates
- B. Classification of carbohydrates
- C. Optical activity

XI. Lipids
- A. Structure and occurrence of lipids
- B. Compound lipids
- C. Essential fatty acids

XII. Amino Acids and Proteins
- A. Structure and nomenclature of amino acids
- B. Protein structure, the peptide bond
- C. Classification of proteins
- D. Essential amino acids
- E. Urea

XIII. Nucleo-Proteins
- A. Composition of nucleo-proteins
- B. Function of nucleo-proteins in biological systems
- C. The structure of RNA and DNA

XIV. Enzymes
- A. Nature and function of enzymes
- B. Influences on enzyme activity
- C. Digestion
- D. Vitamins

XV. Hormones
- A. Steroids
- B. Androgens
- C. Estrogens

Suggested Laboratory Projects (48 hours)

1. Basic Techniques (3 hours)
   a. Orientation in the laboratory
   b. Use of measuring devices
      (1) Eyedropper
      (2) Measuring and volumetric pipettes
      (3) Burette
      (4) Graduated cylinder
      (5) Volumetric flask
2. Basic Techniques — Continued (3 hours)
   a. Use of trip and torsion balance
   b. Use of gas burner
   c. Determination of organic matter content in feces by combustion of an air dried sample
   d. Density and specific gravity
3. Chemical and Physical Changes; Reactions (6 hours)
   a. Positive heat of solution
   b. Endothermic reaction
   c. Percentage solution; dilutions
   d. Reactions between salts
   e. Reactions of metals and salts with acids
   f. Reactions of bases with acids
4. Solutions (6 hours)
   a. Solubility and solvents
   b. Particle size and solubility
   c. Saturated and supersaturated solutions
   d. Molar and normal solutions
   e. Titration
5. Electrolytes (6 hours)
   a. Ionization and conductivity
   b. Qualitative analysis
   c. Hydrogen-ion concentration
   d. Color indicators
   e. Potentiometer
6. Acid-base Reactions (3 hours)
   a. Acid-base titration
   b. Determination of total active and reserve acidity
7. Colloidal Studies (3 hours)
   a. Properties of colloids; the Tyndal effect
   b. Surface activity
   c. Precipitation of a colloid
   d. Protective action of a colloid
8. Organic compounds (3 hours)
   a. Comparison of inorganic and organic compounds
   b. Organic solvents
   c. Preparation of an ester
   d. Preparation of aspirin
9. Carbohydrates (3 hours)
   a. General test for carbohydrates
   b. Benedict and Seliwanoff tests; lab-stix
   c. Iodine test for starches
   d. Acid hydrolysis of starch
10. Lipids (3 hours)
    a. The acrolein test
    b. Iodine test for unsaturated fats
    c. Preparation of soap
    d. Free fatty acids from soap
    e. Fat solvents
11. Amino Acids and Proteins (6 hours)
    a. Ninhydrin test
    b. Burrette test
    c. Physical properties of proteins
    d. Separation of globulin from serum by saturated salt solutions
    e. Determination of serum albumin/globulin ratio in various species

12. Enzymatic Studies (3 hours)
    a. Reaction of invertase on sucrose
    b. Reaction of lipase on fats
    c. Reaction of protease on gelatin
    d. Reaction of rennin on milk
    e. Reaction of ptyalin on starch

Texts and References

Estok. *Organic Chemistry a Short Course.*
Hered and Nebergall. *Laboratory Manual: Basic Laboratory Studies in College Chemistry.*
Holum. *Elements of General and Biological Chemistry.*
King and Caldwell. *General Chemistry.*
McElroy. *Cell Physiology and Biochemistry.*
Ouelette. *Introductory Chemistry.*
Routh. *Fundamentals of Inorganic, Organic and Biological Chemistry.*
Selwood. *Chemical Principles.*
———. *General Chemistry.*
Watt and others. *Chemistry in the Laboratory.*

Instructional Media

Indiana University, Bloomington, Indiana (NET) 47401
The Chemical Elements. 35 min., 16 mm., black and white, sound.

Modern Learning Aids, New York, New York 10000
Gasses and How They Combine. 22 min., 16 mm., color, sound.

State University of Iowa, Iowa City, Iowa 52240
Atomic Models, Valence and the Periodic Table. 44 min., 16 mm., color, sound.

U.S. Atomic Energy Commission, Director, Public Information Service, 376 Hudson Street, New York, New York 10014
Understanding the Atom (12 part series). 16 mm., black and white, sound.

INTRODUCTORY MICROBIOLOGY

Hours Per Week

Class, 2; Laboratory 4.

Course Description

An introductory course in microbiology structured to familiarize the student with the characteristics of bacteria, viruses and fungi, particularly as they relate to man's environment. In achieving the objectives of this course, the student will become familiar with the classifications and techniques of identification, culture and control of the common microbial species. Practical relevancy is developed by a detailed study of the modes of action, applications and uses of the various techniques of sterilization and disinfection.

Laboratory sessions include the practice of tests enabling the student to select the optimum control techniques for any given situation. This course is designed to prepare the student for Applied Microbiology by emphasizing basic investigative procedures.

Major Divisions

	Class Hours
I. Introduction to Microbiology	2
II. The Microscope	3
III. Microbial Taxonomy	2
IV. Cellular Morphology	1
V. Staining	1
VI. Bacterial Growth and Metabolism	13
VII. The Fungi	2
VIII. Virus, Mycoplasma and Rickettsia	2
IX. Control of Microbes	4
X. Specimen Care and Shipping	2
Total	32

Units of Instruction

I. Introduction to Microbiology
- A. Microbiology as a part of biology
  1. Characteristics of living things
  2. The protista
- B. History of microbiology
  1. Spontaneous generation
  2. Germ theory of disease
  3. Pasteur
  4. Tyndall
  5. Koch's postulates
  6. Development of vaccines

II. The Microscope
- A. Mechanics of operation
  1. Types
  2. Parts
  3. Use
  4. Care
- B. Theory of operation
  1. Magnification
  2. Numerical aperture
  3. Resolution
  4. Definition
  5. Illumination

III. Microbial Taxonomy
- A. Principles
  1. Basis of classification
  2. Scientific names — binomial system
  3. The classification scheme
  4. Orders of bacteria
  5. Bergey's manual

IV. Cellular Morphology
- A. Shape, size, cell aggregation
- B. Spores, capsules, flagella

V. Staining
- A. Simple stains (methylene blue)
- B. Negative stains
- C. Gram stain
- D. Flagellar stains

VI. Bacterial Growth and Metabolism
- A. Nutritional requirements
  1. Heterotrophs
  2. Autotrophs
  3. Specialized media
- B. Physical conditions
  1. pH
  2. Temperature
  3. pO_2
  4. pCO_2
- C. Growth rates and reproduction
  1. Methods of reproduction
  2. Growth curves
  3. Quantitating bacterial growth
- D. Pure culture isolation and preservation
  1. Methods of pure culture isolation
  2. Preservation of stock cultures
  3. Role of culture characteristics in identification
- E. Enzyme production
  1. Chemical and physical properties
  2. Factors affecting activity

3. Types of enzyme reactions
4. Methods of study

F. Metabolism
1. Fermentation
2. Respiration
3. Carbohydrate breakdown
4. Protein breakdown and synthesis
5. Fat breakdown
6. Integration of metabolic processes
7. Modes of action of antibiotics

VII. The Fungi
A. Molds
1. Morphology
2. Reproduction
3. Cultivation
4. Taxonomy

B. Yeasts
1. Morphology
2. Reproduction
3. Cultivation
4. Taxonomy

VIII. Virus, Mycoplasma and Rickettsia
A. Taxonomy
B. Morphology
C. Composition of viruses

IX. Control of Microbes
A. Introduction
1. Control terminology
2. Effects of time, temperature and species
3. Logarithmic death curve

B. Agents for microbe control
1. Dry heat
2. Boiling water
3. Intermittent steam
4. Steam under pressure
5. Irradiation
6. Filtration
7. Phenols
8. Quarternary ammonia compounds
9. Heavy metals
10. Oxidizing agents
11. Reducing agents

X. Specimen Care and Shipping
A. General considerations
1. Collection of the specimen
2. Information to be submitted with specimen

B. Shipment of specimens
1. Methods of transportation
2. Timing
3. Preservation
4. Transport media

Suggested Laboratory Projects (64 hours)

1. Acquaint the student with the laboratory facilities and with the basic safety procedures of microbiology. (2 hours)
2. Prepare nutrient agar and sterilize by autoclave. (2 hours)
3. Prepare serum agar and sterilize by intermittent steam. (2 hours)
4. Set up microscope and use different objectives for the examination of hay infusion wet mounts, yeast suspensions and prepared slides of body materials showing cocci, bacilli and spirilla. (2 hours)
5. From data sheets describing an organism's characteristics, students use Bergey's manual to describe the taxonomy of a number of organisms. (2 hours)
6. Students collect specimens from a wide variety of sites (toilet bowl, hand towel, shoe sole, desk top, door handle, puddle, etc.) make cultures and study for variety of forms and ubiquity of microbes. (4 hours)
7. Students examine prepared slides demonstrating variety of cell forms, spores, capsules and flagellae. (2 hours)
8. Using swabs of their own interdental detritus students prepare and examine slides and stain them by methylene blue and grams stain. Demonstration of flagellar staining. (2 hours)
9. Determine motility by hanging drop technique. Prepare slides, gram stain and examine cultures of Corynebacterium, Streptococcus and Escherichia. (2 hours)
10. Determine the nutritional adequacy of several types of media using several species of stock cultures. (2 hours)
11. Use enrichment, selective and differential media for three types of cultures to demonstrate the isolation of a specific group or type of bacteria. (2 hours)
12. Perform streak plate and pour plate methods for isolation of pure cultures. (2 hours)
13. Inoculate a Lactobacillus and Alcaligenes onto replicates of nutrient agar and Sabouraud's agar and inoculate at various temperatures to demonstrate effects of pH and temperature upon growth. (2 hours)
14. Perform anaerobic culture methods for the isolation of pure cultures. (2 hours)
15. Demonstrate cultural characteristics for the identification of several types of bacteria using gelatin, nutrient broth, agar slants, and streak plates. (2 hours)

16. Demonstrate hydrolysis of starch, proteins and lipids by bacterial enzymes. (2 hours)
17. Demonstrate the fermentation of carbohydrates by bacteria using various carbohydrates and various species of bacteria. (2 hours)
18. Demonstrate the ability of various types of bacteria to produce hydrogen sulfide. Demonstrate the ability of various types of bacteria to produce catalase. (2 hours)
19. Demonstrate the various types of bacterial reactions occurring in Litmus milk. Demonstrate the ability of some strains of bacteria to produce indole from tryptophane. (2 hours)
20. Determine the reduction of nitrates to nitrites by various species of bacteria. Demonstrate the production of oxidase by some species of bacteria. (2 hours)
21. Perform the Methyl Red-Voges Proskaur tests using various cultures. (2 hours)
22. Identify the two unknown organisms in a mixed culture by evaluating cellular and colonial morphology, cultural and biochemical characteristics according to the various keys in Bergey's Manual. (10 hours)
23. Using petri dishes and slide cultures on Sabouraud's agar study the colonial and cellular morphology of penicillium, microsporum and aspergillus. (2 hours)
24. Determine the tolerance of various types of vegetative and spore forms of bacteria toward wet heat. (2 hours)
25. Perform the Association of Official Agricultural Chemists Phenolcoefficient test. (2 hours)
26. Perform the Chick-Martin test on halogen, quarternary ammonia, heavy metal and phenol-based disinfectants. (2 hours)
27. Perform the Association of Official Agricultural Chemists Use-dilution test on each of the disinfectants in lab. 26. (2 hours)

Texts and References

Breed and others. *Bergey's Manual of Determinative Bacteriology.*
Dubos. *Bacterial and Mycotic Infections of Man.*
Lewis. *Arrowsmith.*
Pelczar and Reid. *Microbiology.*
Stanier and others. *The Microbial World.*
Sykes. *Disinfection and Sterilization.*
Zinsser. *Microbiology.*
———. *Rats, Lice and History.*

Instructional Media

Armed Forces Institute of Pathology, Washington, D. C. 20305
The Microscope, Part I. 27 min., 16 mm., color, sound.
The Microscope, Part II. 15 min., 16 mm., color, sound.

Michigan State University, Instructional Media Center, East Lansing, Michigan 48823
Hospital Sepsis: A Communicable Disease. 26 min., 16 mm., color, sound.
Microscope and Its Use. 10 min., 16 mm., black and white, sound.

National Medical Audiovisual Center (Annex), Atlanta, Georgia 30333
Sterilization Problems and Technics. 30 min., 16 mm., color, sound.

Syracuse University, Film Rental Center, 1455 East Colvin Street, Syracuse, New York 13210
Importance of Microorganisms. 28 min., 16 mm., color, sound.
Protist Kingdom. 13 min., 16 mm., color, sound.
Story of Louis Pasteur. 34 min., 16 mm., black and white, sound.
Viruses. 28 min., 16 mm., color, sound.

COMMUNICATION SKILLS

Hours Per Week
Class, 3

Course Description

This course is based on the premise that communication is basically a thinking act. Effective communicators must be prepared to deal with the two major aspects in communication: their own thinking as readers or listeners, and the thinking of the writer or speaker as they use ideas and the materials of expression. Emphasis should be placed upon exercises in writing, speaking, reading, and listening. These exercises are designed to reinforce the basic principles of communication theory presented.

Each student's strengths and weaknesses in such areas as grammar and usage should be analyzed. The pattern of instruction should be designed to help individual students improve skills in areas where weaknesses are found.

Major Divisions

	Class Hours
I. Introduction to Communication	3
II. Communication: Development of Ideas	9
III. Communication: Analysis and Arrangement of Ideas	9
IV. Communication: Presentation of Ideas	9
V. Communication and the Thought Process	18
Total	48

Units of Instruction

I. Introduction to Communication
- A. Nature and scope
- B. Major purposes
  1. Information
  2. Persuasion
  3. Conviction
  4. Inquiry
  5. Entertainment
- C. The communication process
  1. Communication source
  2. Encoder
  3. Message
  4. Channel
  5. Decoder
  6. Communication receiver
- D. Levels of communication
  1. Interpersonal
  2. Intergroup
  3. Mass

II. Communication: Development of Ideas
- A. Definition of data
- B. Nature of data
  1. Primary source
     a. Sampling and sampling methods
     b. Questionnaires
     c. Interviews
     d. Company records
  2. Secondary sources
     a. Library
        (1) Library classification systems
        (2) Card catalog
        (3) Reference volumes
            (a) Dictionaries
            (b) Encyclopedias
            (c) Annuals and other serials
            (d) Biographical works
            (e) Guides to books and periodicals in print (BIP)
            (f) Indexes to periodicals
                (i) Applied science and technology index
                (ii) Biological abstracts
                (iii) Biological and agricultural index
                (iv) Business periodical index
                (v) Current contents
                (vi) Excerpta medica
                (vii) Index medicus
                (viii) Industrial arts index
                (ix) Monthly catalog to U.S. Government publications
                (x) Nutrition abstracts and reviews
                (xi) Science citation index
            (g) Government documents
            (h) General directories
                (i) Names and addresses of manufacturers, suppliers, or dealers in a specific

field of interest
(ii) Service and product listings
(i) Business or trade directories
b. Other
c. Recording secondary source data
(1) Bibliographical entries
(2) The technique of taking notes
(3) Note card content
(4) Types of notes
(a) Précis or summary
(b) Paraphrase
(c) Quotation
(d) Critical
(5) Documentation of material

III. Communication: Analysis and Arrangement of Ideas
A. Nature of analysis
B. Patterns of content analysis
1. Descriptive
2. Historical
3. Problem-solving
4. Logical
5. Psychological
C. Audience analysis
1. Planning the message
a. Delimitation of topic
b. Formulation of specific purpose
c. Development of major ideas or patterns
d. Selection of supporting details
e. Choice of language
2. Evaluation of message effects
3. Approaches to audience analysis
a. Demographic analysis
b. Purpose-oriented analysis
D. Arrangement of material
1. Topical
2. Spatial
3. Chronological
4. Problem-solution
5. Causal
6. Psychological
E. Patterns of outlining
1. Coordination
2. Subordination
3. Sequence
4. Symbolization

IV. Communication: Presentation of Ideas
A. Style to attain clarity
1. Purposeful introduction
2. Appropriate word selection
3. Simplicity of sentence structure
4. Use of supporting materials
a. Definition
b. Example
c. Illustration
5. Meaningful transitional materials
6. Purposeful summaries
B. Style to make a predictable impression
1. Modes of expression
a. Logical
b. Emotional
c. Ethical
d. Artistic
2. Sentence structure
3. Emphasis
a. Repetition
b. Climax
4. Rhythm
5. Imagery
C. Qualities to be developed
1. Accuracy
2. Simplicity
3. Propriety
4. Effectiveness
5. Economy
6. Liveliness
D. Contrasts between oral and written styles of discourse

V. Communication and the Thought Process
A. Logic
1. Induction
2. Analogy
3. Casual reasoning
4. Deduction
B. Emotion and emotional appeals in communication
1. Problems of emotional appeals in communication
2. Kinds of emotional appeals
3. Uses of emotional appeals
C. Ethics and ethical appeals in communication
1. Problems of ethics in communication
2. Types of ethical appeals
3. Uses of ethical appeals
4. Propriety of ethical appeals

Texts and References

Beardsley. *Thinking Straight.*
Berlo. *The Process of Communication.*
Brown. *Words and Things.*
Campbell and Helpler. *Dimensions in Communication.*
Case and Vardaman. *Mature Reading and Thinking.*
Dance. *Human Communication Theory: A Book of Readings.*
Dean and Bryson. *Effective Communication.*
Eisenson and others. *The Psychology of Communication.*
Fowler. *A Dictionary of Modern English Usage.*
Nicholson. *A Dictionary of American-English Usage.*
Strunk. *The Elements of Style.*

Instructional Media

Cornell University, Film Library, Department of Communication Arts, Roberts Hall, Cornell University, Ithaca, New York 14850

Talking Sense: Just What is General Semantics? 30 min., 16 mm., black and white, sound.

Michigan State University, Instructional Media Center, East Lansing, Michigan 48823

Meanings are in People. 24 min., 16 mm., color, sound.

Missed Signals in Extension. 12 min., 16 mm., black and white, sound.

Syracuse University, Film Rental Center, 1455 East Colvin Street, Syracuse, New York 13210

Communication by Voice and Action. 14 min., 16 mm., color, sound.

Communications Primer. 22 min., 16 mm., color, sound.

English Language: Patterns of Usage. 11 min., 16 mm., color, sound.

Marshall McLuhan: Medium is the Massage. 55 min., 16 mm., color, sound.

GENERAL AND INDUSTRIAL ECONOMICS

Hours Per Week

Class, 3

Course Description

A Study of economics designed to impart a basic understanding of the principles of economics and their implications; to develop the ability to follow an informed personal finance program; to aid in the development of intelligent consumption; and to provide an understanding of the underlying relationship of cost control to success in industrial enterprise. The programs or problems worked upon by any technician in either research, practice, or production ultimately must be measured by a cost analysis. Awareness of this fact and a knowledge of elementary economics prepares the students for the cost-conscious environment of their future employment. It is suggested that instruction in this course be based on this pragmatic approach and that students be encouraged to study examples from industry as they learn about industrial cost analysis, competition, creation of demand, economic production, and related aspects of applied economics.

Major Divisions

	Class Hours
I. Introduction	2
II. Economic Forces and Indicators	3
III. Natural Resources - The Basis of Production	3
IV. Capital and Labor	3
V. Business Enterprise	7
VI. Factors of Industrial Production Cost	8
VII. Price, Competition, and Monopoly	5
VIII. Distribution of Income	2
IX. Personal Income Management	2
X. Insurance, Personal Investments, and Social Security	3
XI. Money and Banking	3
XII. Government Expenditures, Federal and Local	3
XIII. Fluctuations in Production, Employment and Income	2
XIV. The United States Economy in Perspective	2
Total	48

Units of Instruction

I. Introduction

II. Economic Forces and Indicators
- A. Economics defined
- B. Modern specialization
- C. Increasing production and consumption
- D. Measures of economic activity
  1. Gross national product
  2. National income
  3. Disposable personal income
  4. Industrial production
  5. Employment and unemployment

III. Natural Resources - The Basis of Production
- A. Utilization and conservation of resources
- B. Renewable resources
- C. Nonrenewable resources
- D. Future sources

IV. Capital and Labor
- A. Tools (capital)
  1. The importance of saving and investment
  2. The necessity for markets
- B. Large-scale enterprise
- C. Labor
  1. Population characteristics
  2. Vocational choice
  3. General education
  4. Special training
  5. Management's role in maintaining labor supply

V. Business Enterprise
- A. Forms of business enterprise
  1. Individual proprietorship
  2. Partnership
  3. Corporation
- B. Types of corporate securities
  1. Common stocks
  2. Preferred stocks
  3. Bonds
- C. Mechanics of financing business
- D. Plant organization and management

VI. Factors of Industrial Production Cost
- A. Buildings and equipment
  1. Initial cost and financing
  2. Repair and maintenance costs
  3. Depreciation and obsolescence costs
- B. Materials
  1. Initial cost and inventory value
  2. Handling and storage costs
- C. Processing and production

1. Methods of cost analysis
2. Cost of labor
3. Cost of supervision and process control
4. Effects of losses in percentage of original product compared to finished product (yield)

D. Packaging and shipping
E. Overhead costs
F. Taxes
G. Cost of selling
H. Process analysis, a means to lower costs
I. Profitability and business survival

VII. Price, Competition, and Monopoly
A. Function of prices
B. Price determination
1. Competitive cost of product
2. Demand
3. Supply
4. Interactions between supply and demand

C. Competition, benefits and consequences
1. Monopoly and oligopoly
2. Forces that modify and reduce competition
3. History of government regulation of competition

D. How competitive is our economy

VIII. Distribution of Income
A. Increasing real income
B. Marginal productivity
C. Supply in relation to demand
D. Income resulting from production
1. Wages
2. Interest
3. Rents
4. Profits

E. Income distribution today

IX. Personal Income Management
A. Consumption - the core of economics
B. Economizing defined
C. Personal and family budgeting
D. Analytical buying
1. Applying quality standards
2. Consumer's research and similar aids

E. The use of credit
F. Housing - own or rent

X. Insurance, Personal Investments, and Social Security
A. Insurance defined
B. Life insurance
1. Group, industrial, and ordinary life policies
2. Type of policies - their advantages and disadvantages

C. Casualty insurance
D. Investments
1. Savings accounts and Government bonds
2. Corporation bonds
3. Corporation stocks
4. Annuities
5. Pension plans

E. Social Security
1. Old-age and survivors' insurance
2. Unemployment compensation
3. Medicare

XI. Money and Banking
A. Functions of money
B. The Nation's money supply
C. Organization and operation of a bank
1. Sources of deposits
2. The reserve ratio
3. Expansion of bank deposits
4. Sources of reserves

D. The Federal Reserve System
1. Service functions
2. Control of money supply

E. Federal Deposit Insurance Corporation

XII. Government Expenditures, Federal and Local
A. Economic effects
B. Functions of Government
C. Analysis of Government spending
D. Future outlook
E. Financing Government spending
1. Criteria of sound taxation
2. Tax revenues in the United States
3. The Federal and State personal income taxes
4. The corporate income tax
5. The property tax
6. Commodity taxes

XIII. Fluctuations in Production, Employment and Income
A. Changes in aggregate spending
B. Output and employment
C. Other factors affecting economic fluctuations
1. Cost-price relationship
2. Fluctuations in demand for durable goods
3. Involuntary fluctuation of supply of commodities
4. Economic effects of war
5. Inflation and deflation of currency value

6. Economic effects of inventions and automation

D. Means of implementing fiscal policy

E. Government debt

1. Purpose of Government borrowing
2. How burdensome is the debt
3. Problems of debt management

XIV. The United States Economy in Perspective

A. Recent economic changes

1. Increased productivity and well-bring
2. Effects of war and depression
3. New products and industries
4. Increase in governmental controls

B. Present economic problems of U.S. economy

1. The world market - a community of nations
2. International cooperation
3. Maintenance of prosperity and progress
4. Economic freedom and security

C. Communism: Nature and control by Soviet State

D. Fascism

E. British socialism

F. Problems common to all economic systems

G. Special economic problems of the United States

Texts and References

Blodgett. *Comparative Economic Systems.*
Donaldson and Pfahl. *Personal Finance.*
Dunlop. *Automation and Technological Change.*
Dye. *Economics: Principles, Problems, Perspectives.*
Edwards. *The Nation's Economic Objectives.*
Gordon. *Economics for Consumers.*
Katona. *The Mass Consumption Society.*
Pond. *Essential Economics: An Introduction.*
Reynolds. *Economics: A General Introduction.*
Samuelson. *Economics: An Introductory Analysis.*
Schultz. *The Economic Value of Education.*

Instructional Media

McGraw-Hill Book Co., Inc., 330 West 42nd Street, New York, New York 10036

Basic Economic Concepts. Set of four 35 mm. filmstrips, black and white.

Business Cycles and Fiscal Policy. 35 mm. filmstrip, black and white.

Money, Price, and Interest. 35 mm. filmstrip, black and white.

Savings and Investment. 35 mm. filmstrip, black and white.

Supply and Demand. 35 mm. filmstrip, black and white.

HUMAN RELATIONS

Hours Per Week
Class, 3

Course Description

This course is designed to assist the student in applying for, securing and advancing on the job as a successful technician with supervising capabilities. In implementing this course, students should be given an opportunity to prepare application forms and letters of application for positions. Also, they should examine copies of applications of others and evaluate them. In the latter case, the identity of the applicant may be concealed. The forms may be examined by means of a projector or by giving copies to each student. Letters of application may be prepared and studied in a similar manner.

Interviews may be demonstrated by a role-playing procedure, using prospective employers or others to interview students in front of the class. Reports of experiences of students who have had interviews may also be included.

Other areas of human relations, which offset supervisors, are also explored. The roles of organizations and unions as they affect productivity and morale are investigated.

The course concludes with a discussion of the deleterious effects of employment discrimination and suggests methods of correction where such exists. The attitude of Government in the area of employment discrimination is also explained and discussed.

Major Divisions

	Class Hours
I. Getting a Job	5
II. Functions of Supervision	4
III. Functions of Employees	3
IV. In-Service Training of Employees	4
V. Customer Relations	4
VI. Motivation	4
VII. Morale	3
VIII. Organizational Dynamics	5
IX. Discipline	6
X. Counseling and Interviewing	3
XI. Organizations and Unions	4
XII. Employment Discrimination	3
Total	48

Units of Instruction

I. Getting a Job
- A. What employers want
  - 1. Desirable attitude toward the job
    - a. Willingness to work
    - b. Ability to get along with others
    - c. Characteristics of leadership
    - d. Teamwork
  - 2. Ability necessary to do the job
    - a. Carry out the policies of the firm
    - b. Follow the best safety practice at all times
    - c. Project the best possible image of the firm
  - 3. Adequate training for the job
    - a. Competent for the present job
    - b. Ability and willingness to progress through
      - (1) Further training for promotion
      - (2) Retraining to keep abreast of new technology
- B. Applying for the job
  - 1. Types of interviews
  - 2. Preparing and presenting credentials
    - a. Personal data: name, address, age, marital status, health, military service
    - b. Education: schools attended, major courses
    - c. Work experience: place of employment, kind of work, length of employment
    - d. References
    - e. Hobbies
  - 3. Understanding job descriptions
  - 4. Writing letters of application

II. Function of Supervision
- A. Techniques of supervision of employees
  - 1. Delegation of responsibility and authority
  - 2. Accountability of employees
  - 3. System of awards
- B. Labor-management relations
  - 1. Promotion policies
  - 2. Worker grievances
  - 3. Wages, benefits program
  - 4. Legal regulations (wages and hours, child labor, nondiscrimination)

III. Functions of Employees
- A. Responsibility to management
  - 1. Perform assigned tasks in a satisfactory manner

2. Carry out the policy of management
3. Do an adequate day's work
4. Keep management informed
   a. Working conditions
   b. Safety conditions
   c. Condition of product
   d. Condition of machinery, buildings and equipment
5. Project desirable company image

B. Responsibility for self-improvement
1. Aware of need for keeping up-to-date
2. Recognizing the need for self-improvement
3. Accepting the opportunity for self-improvement
   a. Self study
   b. In-service training

IV. In-service Training of Employees
A. Orientation of new workers to the job
B. Participation in programs for up-dating workers
1. Products
2. Techniques and equipment
3. Uses for a product
4. Government regulations and policies
5. Economic situations

C. Where to get in-service training
1. In-plant training offered by the firm
2. Short courses, summer schools, institutes offered by universities and vocational-technical centers
3. Adult evening school programs
4. Private technical institutions

V. Customer Relations
A. Handling customer complaints
B. Serving the customer
C. Neat appearance
D. Product information
E. Neat building and grounds
F. Off-duty responsibility to the firm
G. Other

VI. Motivation
A. McGregor's X and Y theories
B. Maslow's heirarchy of needs
C. Hertzberg's two factor theory

VII. Morale
A. The nature of morale
B. Morale and productivity
C. Security morale information

VIII. Organizational Dynamics
A. Structures and peoples
B. Specialists
C. Span of management
D. Size of organization

IX. Discipline
A. Early discipline
B. Insubordination
C. Absenteeism
D. Fights and quarrels
E. Dishonesty
F. Incompetency
G. Discipline of supervisors

X. Counseling and Interviewing
A. The need for counseling
B. Types of counseling
C. Interviewing techniques

XI. Organizations and Unions
A. Professional organizations
B. Informal organizations
C. Trade unions

XII. Employment Discrimination
A. Women employees
B. Older workers
C. Minority groups
D. Affirmative action planning

Texts and References

Chruden and Sherman. *Personnel Management.*
Garrett. *Ethics in Business.*
Harrington. *Life in the Crystal Palace.*
Palmer. *Understanding Other People.*
Sayles and Strauss. *Human Behavior in Organizations.*
U.S. Department of Labor. *Prepare Yourself for Job Interviews.*

Instructional Media

National Safety Council, 425 North Michigan Avenue, Chicago, Illinois 60611
Down at the Office. 10 min., 16 mm., black and white, sound.
Round Table Films, Inc., 321 South Beverley Drive, Beverley Hills, California 90212
I Just Work Here. 17 min., 16 mm., color, sound.
U.S. Department of Health, Education, and Welfare, Office of Education, Washington, D. C. 20201
A Supervisor Takes a Look at His Job. 13 min., 16 mm., black and white, sound.

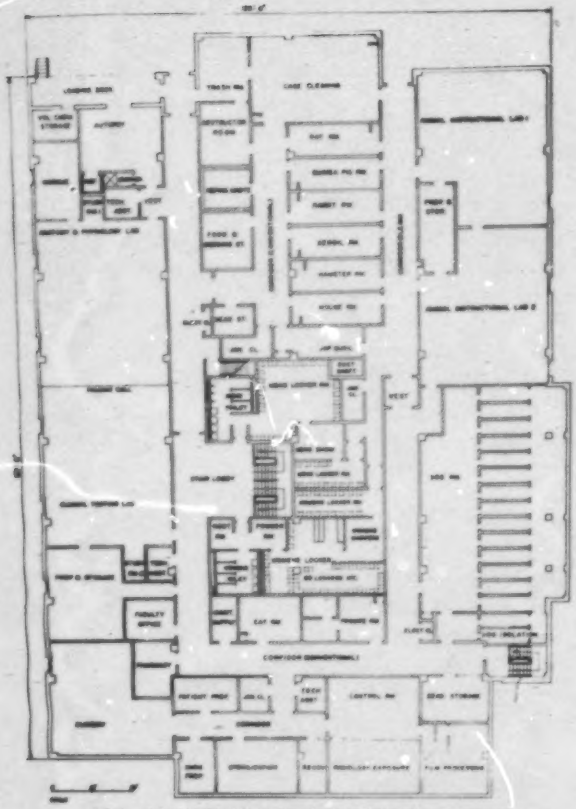

FIG. 11 A FACILITIES PLAN FOR VETERINARY SCIENCE TECHNOLOGY

A most important part of planning any curriculum is the consideration of facilities, equipment, and costs. Administrators, staff, and advisory committees should keep the educational needs described in this guide in mind when planning their facilities. Failure to do so can easily result in facilities that are either inadequate, of the wrong type, or too elaborate to provide optimum instruction.

GENERAL PLANNING

The suggestions that follow are intended as a general guide to groups planning facilities for a program in veterinary science technology or meat inspection and regulatory technology, or both. It is assumed that facilities for general education and related support instruction already exist on the campus. Therefore, the suggestions offered in this guide apply only to those facilities and equipment which will be needed for the technical course areas suggested in the curriculum.

Those responsible for planning facilities should give serious consideration to other programs with facilities which may be shared. In fact, the building plans shown in Figure 11 represent one floor of a two-story facility which also houses related programs. It should be noted that this facility is so planned that the laboratories have consumed the entire outside wall space. The design utilizes a central men's and women's locker and restroom area, with a staircase leading to the divisional or departmental and faculty offices and agricultural or health-related laboratories beneath. A loading-docking area and exits are located at the rear of this second story facility.

The facilities plan for the veterinary science technology program illustrated in Figure 11, has been subdivided into major functional laboratory complexes as shown in Figures 12, 14, 15, and 17 in greater detail. The specialized facility for the optional meat inspection laboratory is illustrated in Figure 19.

Since the facilities suggested for this curriculum are designed to be usable, as well, for associated agricultural or health-related programs, there is a possibility of occasionally scheduling laboratory space and equipment in this facility for students in the other programs. However, those planning any such use should bear in mind that even though some equipment can be used for other curriculums, the facilities suggested in this guide will be needed primarily for the veterinary science technology program. Obviously, students in the veterinary science technology program will need to share lecture, library and physical education classroom spaces with other students in facilities additional to those presented here.

Some schools in the beginning, may offer either the veterinary science technology program or the optional program for meat inspection and regulatory technology, but not both. Therefore, the breakdown of facilities, equipment, and costs are shown separately for the primary functional laboratories, the over-all veterinary science technology facility, and the separate meat inspection facility, in the summary total following. Much of the recommended equipment would be common to either option.

The planning of buildings and facilities should always include some provision for growth. It is recommended that classroom facilities be close enough to the rest of the campus to be an integral

part of it and to allow adequate passing time between classes.

LAND REQUIREMENTS

The amount of land provided for a veterinary science technology program may vary depending on the ease with which land can be made available, the expected size of the program 5 or 10 years after it has started, and other factors, such as the extent of the total campus property or availability of adjacent land for a farm complex. Whatever amount of land is considered to be appropriate for a specific program, it is recommended that the land be owned by the institution, or controlled by a long-term lease.

The building site should be situated in a well-drained area and furnished with sufficient roadways for easy access to the rear loading and docking area. Walkways and landscaping should be provided so as to blend with the physical and esthetic qualities of the total campus.

LABORATORY FACILITIES AND EQUIPMENT

The number and size of laboratories and related classrooms, offices and storage rooms required for instruction in veterinary science technology depends on whether the optional meat inspection and regulatory program will also be established and the number of students enrolled in each area. These facilities could be arranged in many different ways. However, the plans presented here are designed to provide efficiency and flexibility in operation.

Buildings should be constructed to suit the geographic region. If constructed of masonry, they may be more permanent, easily cleaned, and easily heated in a temperature climate than if constructed of other common materials. Little maintenance is required for such a building. The roof could be of the built-up flat type. The floors, walls, and ceilings should be impervious to acids, alkalies, and other chemicals and easy to keep clean.

Hot and cold water, compressed air, and gas service are required in all laboratories. An abundant supply of cold and hot water and steam is also essential in the autopsy area, the cage cleaning area, and the meat inspection laboratory. Oxygen supply is an additional requirement in the surgical area. Service lines for each should be planned for the shortest length of piping consistent with laboratory arrangements. They should be hidden as far as practicable but control points should be planned for safety, accessibility, and ease of maintenance. It is recommended that each laboratory have a master control panel with a shut-off valve for each utility. This master control panel should have a locking door so that utilities can be controlled at a central point.

Classrooms and laboratories should be well-lighted with a recommended minimum of fifty-foot candles of light at the table or desk tops. Fluorescent lighting is satisfactory. Incandescent lighting will give ample lighting in storage rooms and toilets.

Electrical services should provide both 110 and 220 volt single-phase electrical service for laboratories. Most equipment used in the laboratory requires 110 volts; occasionally a 220 volt single-phase current is required. In connecting electrical service to laboratory benches it is suggested that each be connected to a separate circuit breaker. Each laboratory should have a separate master distribution control panel for electrical circuits. Careful thought should be given to placement of electrical outlets in the most convenient location for use. An emergency electric generator system should be built in to provide power for the environmental control system, at least for the animal maintenance areas. *This is essential or loss of animal life could occur.* Complete environmental controlled air conditioning is required by law. Specifications can be found in the Institute of Laboratory Animal Resource's guide, which outlines such requirements as twelve air changes per hour and 100% air exhaust.[9] Further, compliance with standards found in the I.L.A.R. guide is necessary for accreditation of facilities involved in laboratory animal research. *A consultant who is familiar with environmental control systems for animal quarters should be engaged when planning this phase of construction.*

Adequate telephone service can be an important time saver for the teaching staff. Outlets might well be placed at remote ends of the laboratories and instructional areas away from the buildings.

Careful planning and good practices to assure the safety of people and property must always be emphasized. Doors must be made large enough and multiple exits must be provided. Mechanized equipment to handle heavy objects should be provided. Safe methods and practices should be emphasized at all times.

[9]Institute of Laboratory Animal Resources. *Guide for Laboratory Animal Facilities and Care.* Washington, D.C.: The Institute, 1968.

The Basic Sciences Laboratory

The Basic Sciences laboratory, illustrated in Figure 12, provides a facility for instruction in anatomy and physiology, laboratory techniques, and applied microbiology plus an associated autopsy and morgue (cadaver storage) area. Also included is a laboratory preparation room, a faculty office and areas for five student study carrels. The main laboratory area has been designed with flexibility since it can be scheduled for one large laboratory class or two smaller classes being conducted simultaneously.

It is very important that all laboratories be designed with adequate individual student work space and the proper equipment and utilities, as suggested in this guide. Floor plans reflect the need for the instructor to be readily accessible to each student at all times. Also adequate storage space has been provided in each laboratory suite for all supplies, instruments, and equipment which will be needed for conducting each semester course. Figure 13 illustrates one example of the type of student work table (with associated utilities and services) which would be required in the Basic Sciences Laboratory for instruction in courses such as laboratory techniques or Applied Microbiology. There are many additional diagnostic or testing instruments, not shown in the picture, which are very expensive but essential to courses conducted in this laboratory. These items are outlined, however, in the equipment list which is keyed to this laboratory complex and directly follows this description of laboratory facilities. Figure 9 (page 58) illustrates another example of a type of student work table which could be considered as an alternate, for use in one-half of the Basic Sciences Laboratory. This type of table requires only electrical service (for use of microscopes) and where other utilities and services are supplied peripherally to student work areas, is sufficient for instruction in courses such as Comparative Anatomy and Physiology.

The Research Laboratory Complex

The Research Laboratory Complex (shown completely in Figures 14 and 15) is separated into two specific operational, instructional areas. Each area is designed to provide the student with a full range of training experiences involving vivarial care and experimentation in the use of conventional as well as disease-free, quality animals. The two instructional areas in the Research Laboratory Complex

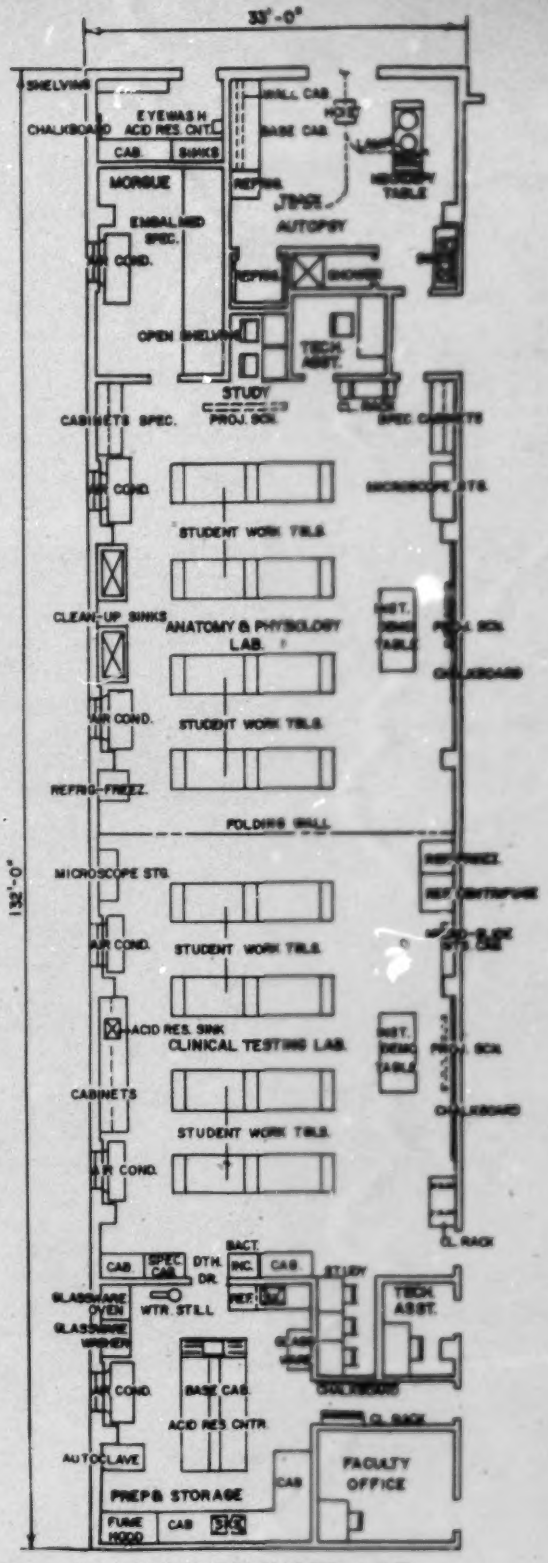

Figure 12 BASIC SCIENCES LAB.

Figure 13—A class, such as this in hematology, requires a rather sophisticated facility, equipped with many expensive items of clinical laboratory testing instruments. Note that ample individual work space with proper utility services must be provided.

are defined as the Conventional Research Laboratory and the Maximum Barrier Research Laboratory.

The Conventional Research Laboratory. This area provides clean, comfortable housing and maintenance for dogs, cats and primates (species which in commercial breeding and research facilities are usually housed in strictly *conventional* areas of the vivarium). The utilization of this animal area in conjunction with Animal Instructional Laboratory No. 2 provides the student with a practice complex where demonstrations can be programmed and individual student proficiencies developed which relate to routine care, health, clinical sampling and development of experimental techniques on three animal species of extreme importance in the field of biomedical research at the present time. Both the animal rooms and the Instructional Laboratory No. 2 can be entered from the conventional corridor. Figure 14 illustrates a suggested plan for this portion of the Research Laboratory Complex.

The Maximum Barrier Research Laboratory. Widely practiced at present in many commercial laboratory animal breeding establishments and to a limited, but increasing extent in the research sector, is the *maximum barrier* concept relating to design and operation of vivarial facilities. This sophisticated and expensive, yet essential portion of the research laboratory complex, is demonstrated in Figure 15. Specifications for the proper size, type and construction of equipment required in this area are as exacting as for the facility itself. The *maximum barrier* concept, which emphasizes a high quality approach to building design, environmental system, sanitation, animal quality and preparedness of personnel working in this type facility, is concerned at present primarily (but not exclusively) with rodents

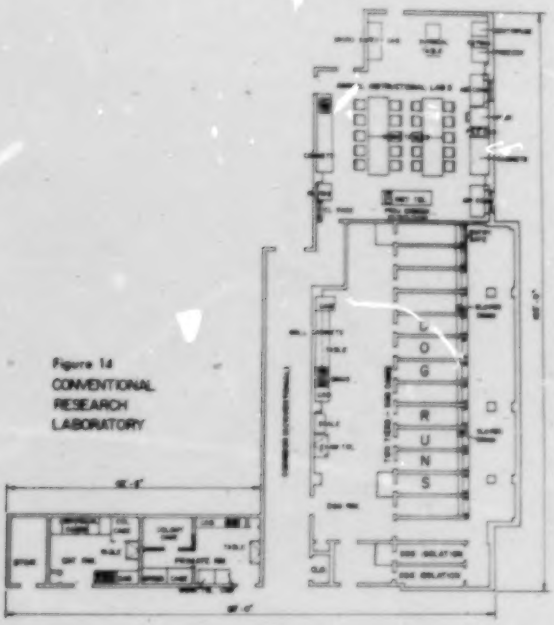

Figure 14
CONVENTIONAL
RESEARCH
LABORATORY

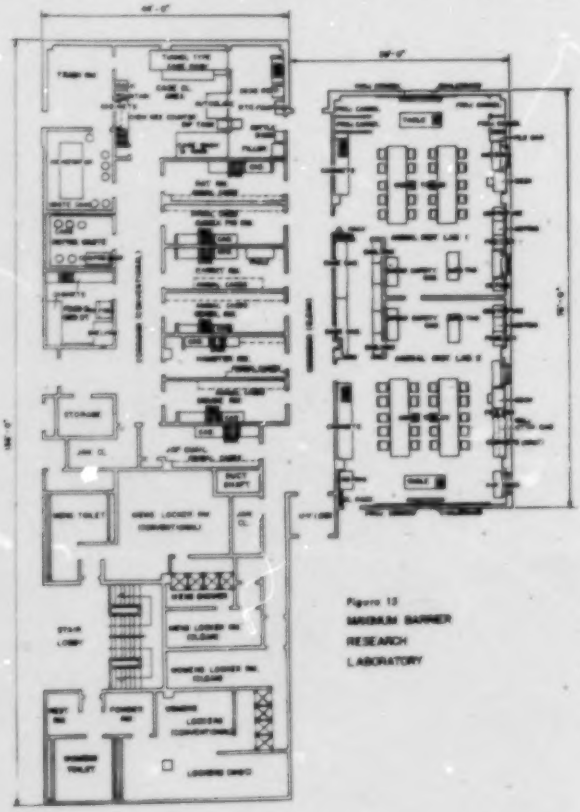

Figure 15
MAXIMUM BARRIER
RESEARCH
LABORATORY

and other smaller species of laboratory animals.

The Maximum Barrier Research Laboratory includes seven breeding rooms, an adjacent Animal Instructional Laboratory (Laboratory No. 1 in Figure 11), a *clean* corridor, an equipment wash room area, and a personnel shower and locker area. It provides the student with an opportunity, while still in college, to become acquainted with the design and operational aspects of this type facility, which is found in many research institutions. Representative of the intricacies of the function and design which enables the rearing and maintenance of disease-free animals in this facility are: the autoclaving of all supplies entering the *maximum barrier* area: a sophisticated environmental system which includes the ultrafiltration, tempering, humidity controlling and differential pressuring of air flow according to areas within the barrier complex; the surgical derivement of all animals being entered into the barrier area; the continuous operation of high level sanitation programs which include showering and the use of sterile uniforms by personnel. Note in Figure 16, an illustration of the size and type of cage washer which is required to clean all sizes of racks and cages and provide an integral "pass-through" from *dirty* to *clean* areas of the complex.

Training obtained in this type facility adds a high degree of sophistication to the education of the student and a degree of technical proficiency which is not only consistent with the present standards but also preparatory for the future in laboratory breeding and biomedical research. When an initiating institution adopts this portion of the research laboratory complex in its building plans, it should do so with the knowledge that the quality of operational plan, environmental controls and equipment required and suggested in this guide will not be compromised. For further guidance in planning a facility of this type, due to the uniqueness of design, it is recommended that contact be made with individuals or institutions familiar with *maximum barrier* types of facilities.

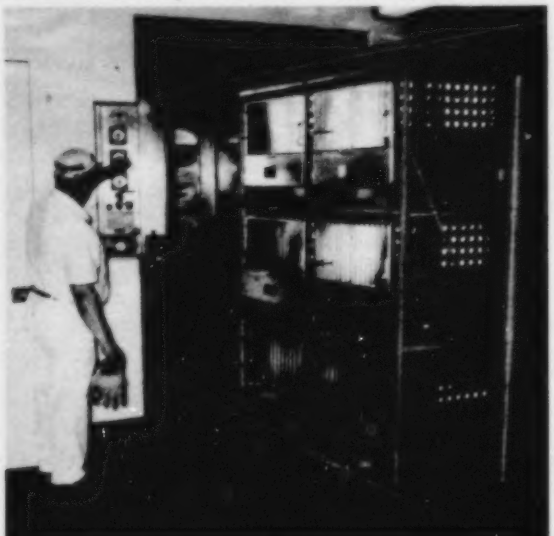

Figure 16 — Cage washers, of the size and type demonstrated here, are an essential and integral part of Maximum Barrier Systems. Note the operator adjusting the automatic control mechanism; the stainless steel construction; and the "pass-through" (double door) design.

The Surgery — Pharmacy — Radiology Clinical Laboratory

This laboratory is designed to reflect a clinical approach to instruction in surgical assisting, anesthesiology and radiological techniques. Where conditions and situations allow, the addition of a veterinary out-patient clinic would also be desirable. (In some institutions instructing in veterinary science technology, this may not be allowed.) Figure 17 illustrates a suggested floor plan for this clinical laboratory area. One example of a surgical laboratory, including a portion of the required equipment and instruments, is illustrated in Figure 18.

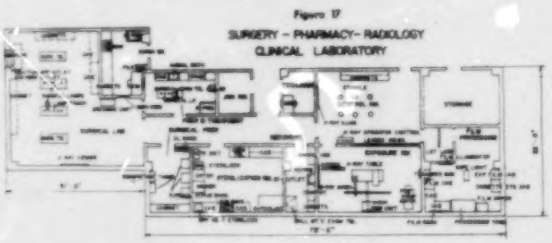

Figure 18 — A surgical laboratory requires a variety of specialized equipment items such as the anesthetic machines, operating tables, and lamps shown here.

The Meat Inspection Laboratory

This facility is optional if there is a cooperating commercial plant located in a nearby community to which students could be transported for laboratory instruction. The building must be on ground level but does not necessarily have to be located near the main facility. The suggested floor plan, which includes no classroom areas, is illustrated in Figure 19.

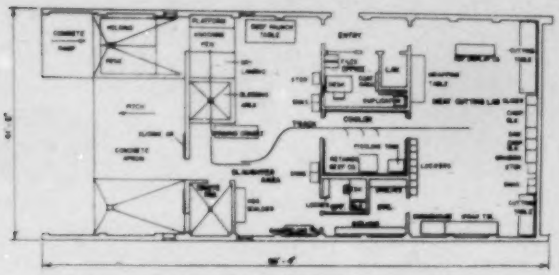

Figure 19 MEAT INSPECTION LABORATORY

ACQUISITION OF EQUIPMENT, AND ESTIMATED COSTS

The need to have adequate facilities and equipment for the veterinary science technology program has already been emphasized. The initial cost of facilities and equipment is a major expenditure. The importance of using the combined expert knowledge of (a) the local advisory commitee which advocates and supports the program, (b) the consultants who are a part of an existing and successful program, and (c) the head of the veterinary science technology program being planned, cannot be over-emphasized when plans and estimates of costs of facilities are made. Each program with its total facilities will be different from others because of local or regional employment opportunities, climatic differences, and many other factors.

Specific facilities and equipment for any program should be acquired only after specialists who are technically competent in the field have made exhaustive studies of the plans for, and potential suppliers of, materials and services. The department head who will be responsible for the program should be deeply involved and carry the major responsibility for final planning and acquisition of facilities and equipment. This will avoid the costly mistakes which often result if non-technical personnel attempt to plan and equip technical program facilities.

There are many sources of equipment that should be explored in an effort to equip the program with up-to-date, adequate machinery and apparatus at minimum cost. Surplus equipment from either private or public organizations may be found acceptable for equipping laboratories. Government surplus property may often be an especially attractive source of either standard or specialized units, apparatus, instruments, and equipment, the cost of which usually is only a small fraction of the original cost. Educational institutions are high on the priority list of agencies to which government surplus property is made available.

Distribution of surplus property within the states is made through state agencies for surplus property. Most such state agencies maintain one or more distribution centers at which authorized representatives of eligible schools or school systems select materials for educational use. The Director of Vocational and Technical Education in each state can provide specific information on the location of the government surplus property distributing agency in his state.

Experience has shown that it is important to exercise the same elements of judgment and care in acquiring surplus equipment as are used when buying new equipment. Specifically, before purchase the following steps should be taken: a careful analysis should be made of its total effectiveness in the program; its cost should be determined, including purchase price, transportation charges, and installation, repair and maintenance expense; and its rate of obsolescence should be considered.

Only technically competent, responsible, and imaginative persons should select surplus equipment, and then only after a thorough on-site inspection. This practice avoids the temptation to acquire attractive but obsolete, irrelevant, or inefficient equipment. With these precautions in mind, resourceful department heads or instructors can often obtain instruments, apparatus, and other essential up-to-date equipment for their laboratories and shops at a very reasonable cost.

The suggested equipment for laboratories and facilities listed on the following pages is rather extensive. Careful consideration has been given to the various types of units and mounts of equipment shown and the contributions of each of the educational program. It represents a list considered adequate for the program in veterinary science technology and/or the optional meat inspection and regulatory technology program, as in-

dicated. Cost estimates shown are representative of those prevailing when this guide was developed (1972) and may vary from 10 to 20 percent from one region or community to another.

Basic Sciences Laboratory Equipment

Item	Quantity
Teacher demonstration lecture table — clinical test area	1
Student laboratory work tables — 4 stations/table	8
Student laboratory chairs	32
Bacteriological incubator	2
Histological slide warmer — 48 slide	4
Ultra-centrifuge	1
Clinical centrifuge — bench type	8
Micro-capillary centrifuge	8
Analytical balance	3
Animal scale — 300 lb. capacity, platform type	1
Gas chromatograph, Chromalyzer-100 — complete	1
Flame photometer	1
Colorimeter	3
Paraffin dispenser	4
Tissue flotation bath — ring type	15
Water bath — serological	2
Unitest kit — blood/urine complete	4
Prothrombin analyer	1
Auto-analyzer	1
Microtome strop	2
Coulter particle counter — with vacuum (Clinician Model)	2
Pipette shaker — 8 pipette capacity	8
Microtome	10
Microtome blade sharpener	2
Autotechnicon — automatic tissue processing machine, double unit	2
Paraffin oven — 4.3 cu. ft. capacity	2
Cryostat	2
Tissue filing cabinet	6
Tissue filing cabinet base for above filing cabinets	2
Micro-slide cabinet with base	10
Museum specimen storage cabinet	10
Automatic slider stainer	2
Freezer-dry (lyophylizer) machine — complete	1
Refrigerator-freezer combination — 14 cu. ft. refrigerator, 3 cu. ft. freezer	1
Flourescent antibody scope	1
Microscope — student, binocular, 3 objectives	32
Microscope — dissecting, with stereo zoom	4
Sink — acid resistant	1
Bacteriological hood	1
Microscope — phase contrast, binocular with 35 mm. camera attachment	1
Lectern	1
Cabinets — work top, shelving, locking doors, sink, base	As room allows
Case — mounted above base cabinets with shelving, locking doors	As room allows
Cabinet — for glassware, preparation storage area	As room allows
Cabinet — for chemicals, reagents, etc., acid proof counter	As room allows
Sinks — 1 double with double drainboard; 1 single with single drainboard	2
Shelving	As room allows
Refrigerator-freezer combination — 14 cu. ft. refrigerator, 3 cu. ft. freezer	1
Chairs, lab; for preparation room	4
Micro-slide storage cabinets; for preparation room	4
Water still	1
Demineralizer	1
Autoclave	1
Pipette washer-dryer	2
Automatic pipetter	1
Explosion proof refrigerator	1
Manual pipetter	3
Glassware washer	1
Glass drying oven	1
Chemical scale	2
Teacher demonstration lecture table, anatomy area	1
Student laboratory work tables (2 stations/table)	16
Student laboratory chairs	32
Skeletons — 1 horse, 1 cow, 1 pig, 1 sheep, 1 chimp, 1 Rhesus monkey, 8 dogs, 4 cats, 2 rabbits, 4 rats, 1 chicken	25
Sink — double with drainboard and garbage disposal	2
Electrocardiograph machine	1
Cabinets — wall mounted	As room allows
Wall base cabinets	As room allows
Refrigerator-freezer — 14 cu. ft. refrigerator, 3 cu. ft. freezer	1
Physiograph machine — projector type	2

Item	Quantity
Knife sharpening hone	4
Microscopes — student, binocular, 3 objectives	32
Lectern, with projector storage	1
Wall shelving — stainless steel preferable, morgue area	As room allows
Water hose connection, morgue area	1
Autopsy table — stainless steel, autopsy area	1
Overhead lamp — double surgical	1
Storage cabinet	As room allows
Sink — double sink, double drainboard, garbage disposal unit	1
Cabinet — wall mounted	As room allows
Band saw — floor model	1
Refrigerator-freezer combination — 14 cu. ft. refrigerator, 3 cu. ft. freezer	1
Stools, laboratory	8
Hose connection — heavy duty, hot and cold	2
Hose connection — steam, heavy duty	1
Hoist — electric operated overhead hoist on tracks	1
Refrigerator — walk-in, 5' x 5' with stainless steel shelving	1
Autopsy saw — powered meat saw	1
Autopsy saw — Stryker skull saw	1
Disinfection tub and shower — walk through	1
Total estimated cost	$246,870

Conventional Research Laboratory Equipment

Item	Quantity
Primate cage — surgical recovery, stainless steel	1
Primate cages — maintenance type, individual housing, stainless steel	5
Primate colony cage	1
Garbage disposal unit — for use in floor drain	1
Stainless steel disposal trough — installation under primate cages	1
Cleaning station — hot and cold water, steam with hose, wall mounted	1
Cage flushing device — for primate cages	As required
Primate feed bin	1
Environmental recorder, primate room	1
Work table with storage cabinet — top resistant to chemicals	1
Wall storage cabinet	1
Primate scale — 25-50 lb. capacity	1
Examination table — stainless steel, hinged, wall mounted	1
Ophthalmoscope-otoscope combination, wall mounted	1
Primate metabolism cage — stainless steel, for 25 lb. primate	1
Sink — partitioned type — stainless steel, with drainboard	1
Primate cage — stainless steel transport cage	1
Primate cage — breeding cage	1
Colony-type cat cage	1
Drain — floor, with garbage disposal unit	As required
Cleaning station — hot and cold water, steam with hose, wall mounted	1
Litter boxes (for cat cages)	10
Cat feed and bedding bin	1
Environmental recorder — cat room	1
Work table (storage cabinet) — table top resistant to chemicals	1
Wall storage cabinet	1
Cat scale — Toledo type, 25-50 lb. capacity	1
Examination table — stainless steel, hinged, wall mounted	1
Ophthalmoscope-otoscope combination — wall mounted	1
Sink — partitioned, stainless steel, with drainboard	1
Cat metabolism cage — stainless steel, portable	1
Cat caging — individual stainless steel cages	10
Cat caging exercise platforms — bench type	10
Heating system — in complete floor of the dog runs and "catch area"	As required
Indoor dog run-flushing system	As required
Doors — guillotine, weathertight	30
Doors — pet type, rubber or plastic diaphragm, weathertight	30
Doors, dog run area, hinged from roof, to enclose complete area in case of bad weather	8
Cleaning station — high pressure water, hot and cold water	As required
Fencing — woven wire, heavy duty, stainless steel	As required

Item	Quantity
Gates — woven wire, heavy duty, stainless steel	17
Drain — floor, with garbage disposal unit	As required
Cleaning station — steam with hose, wall mounted	1
Dog feed bin	2
Environmental recorder — dog room	2
Work table — top resistant to chemicals	2
Wall storage cabinet — with sliding doors	1
Dog scale — 300 lb. capacity	1
Examination table — stainless steel, hinged, wall mounted, 22" x 46"	2
Ophthalmoscope-otoscope combination, wall mounted	1
Dog metabolism cage — stainless steel, portable	1
Sink — partitioned type, stainless steel, drainboard	1
Dog cages — individual stainless steel for dogs weighing up to 75 lbs.	
Feed dishes and holders	30
Total estimated cost	$103,660

Instructional Media Equipment

Item	Quantity
Overhead projector, transparency type	5
Overhead projector, opaque type	2
Micro-slide projector	2
Sound-on-slide projector	2
Carousel slide projector, 35 mm. slide type	3
Motion picture sound projector, 16 mm. type	2
Projection tables	5
Projection screen, Dalite type, wall mounted	5
Projection screen, Dalite type, ceiling mounted	1
Projection screen, Dalite type, portable	1
Portable tape recorder, cassette type	2
Portable tape recorder, reel type	1
Complete self-study carrel modules including: carousel slide projectors, 35 mm. slides booth projection screens tape recorder — cassette type motion picture projector, 8 mm. type	9
Total estimated cost	$9,550

Maximum Barrier Research Laboratory Equipment

Item	Quantity
Microscopes — binocular, three objectives	40
Microscopes — dissecting, stereo zoom	8
Germfree isolator — rigid plexiglas type	2
Germfree isolator — flexible plastic, surgical type	4
Germfree isolators — flexible plastic, maintenance type	20
Germfree isolators — stainless steel	2
Accessory isolator components	As required
Micro-biological safety cabinet	2
Water bath — serological	2
Work tables — top resistant to chemicals, 10 stations/table	4
Autoclave — small bench type	2
Scales — rodent type	4
Scales — Toledo verilux model	4
Storage cabinets	As room allows
Countertop cabinets — work station type with microscope storage in base, counter top resistant to chemicals	As room allows
Sinks — double with drainboard	4
Laboratory stools — adjustable	40
File cabinets	2
Tables — instructor's demonstration type	2
Lectern — with projector storage	2
Refrigerator — explosion-proof	2
Upright freezers — explosion-proof	2
Centrifuge — counter top model	8
Centrifuge — floor model	1
Analytical balance — 160 grams capacity	6
Surgical tables — stainless steel, hydraulic, adjustable	4
Hatching incubator	1
Hot air drying oven	2
Incubator — microbiological	2
Water bath — utility	2
Physiograph — projector model	2
Inhalant type anesthetic machine	2
Shelving and racks — metal, open type	As room allows
Storage cabinets	As room allows
Rabbit feed bin	1
Work table — table top impervious to chemicals, storage cabinet beneath	1
Wall storage cabinet	2

Item	Quantity
Rabbit room environmental recorder	1
Scale — Toledo type, 20-25 lb. range, 1 ounce graduations	1
Examination table — stainless steel, wall mounted	1
Ophthalmoscope-otoscope combination — wall mounted	1
Rabbit metabolism cage — stainless steel, portable	1
Sink — double, stainless steel, drainboard	1
Automatic cage watering system	As required
Rabbit cages — individual, stainless steel, for rabbits 18-20 lbs.	20
Rabbit caging — breeding unit	1
Drain — floor, with garbage disposal unit	1
Mouse feed bin	1
Mouse room environmental recorder	1
Work table storage cabinet	1
Wall storage cabinet	2
Mouse scale — exact weight, instant reading	1
Mouse metabolism cages — stainless steel	20
Sink — stainless steel, double compartment, drainboard	1
Racks (cage) stainless steel, 5 shelves, castered	4
Caging (plastic), polycarbonate, 10-1/2" x 19" x 5-1/4"	200
Caging (plastic), polycarbonate, 8" x 12" x 5-1/4"	150
Cage lids — stainless steel, 10-1/2" x 19", feeder type	150
Cage lids — stainless steel, 8" x 12", feeder type	100
Mouse restraining devices — stainless steel	15
Exercise cage, stainless steel with counter	1
Water bottles — glass, 1-pint	400
Sipper tubes — ball bearing ends, stainless steel	300
Rubber stoppers — size 7, 1-hole	300
Drain, floor, with garbage disposal unit	1
Cleaning station, hot and cold water	1
Rat feed bin	1
Rat room environmental recorder	1
Work table storage cabinet — chemical resistant table top	1
Wall storage cabinet	1
Rat scale — exact weight, instant reading	1
Rat metabolism cage — stainless steel	15
Rat exercising cage — stainless steel with counter	2
Rat restraining device — stainless steel	15
Sink — stainless steel, double compartment, drainboard	1
Racks (cage), stainless steel, 5 shelves, castered	4
Caging — plastic, polycarbonate, 10-1/2" x 19" x 6-1/4"	250
Cage lids — stainless steel, 10-1/2" x 19", feeder type	150
Water bottles — glass, 1-pint	300
Rubber stoppers, size 7, 1-hole	300
Sipper tubes — stainless steel, ball-bearing ends	300
Drain, floor, with garbage disposal unit	1
Cleaning station, hot and cold water	1
Guinea pig feed bin	1
Guinea pig room environmental recorder	1
Work table storage cabinet	1
Wall storage cabinet	1
Guinea pig scale — Toledo verilux, instant reading	1
Guinea pig metabolism cage — stainless steel, portable	1
Sink — stainless steel, double compartment, drainboard	1
Caging units — stainless steel, 4 cages/rack for group housing, castered	4
Water bottles — one pint, glass	50
Sipper tubes — stainless steel, ball bearing ends	75
Rubber stoppers — size 7, 1-hole	50
Drain — floor, with garbage disposal unit	1
Cleaning station, hot and cold water	1
Refrigerator — floor type, compact (for keeping fresh green feed)	1
Hamster feed bin	1
Hamster room environmental recorder	1
Work table storage cabinet	1
Wall Storage cabinet	1
Scale — exact weight scale, instant reading	1
Metabolism cage (Hamster) — stainless steel	20
Racks — stainless steel, 5-shelves,	

Item	Quantity
castered	2
Sink — stainless steel, double compartment, drainboard	1
Caging — plastic, polycarbonate, 10-1/2" x 19" x 6-1/4"	150
Cage lids — stainless steel, 10-1/2" x 19", feeder type	100
Exercise cages — stainless steel with counter	2
Water bottles — glass, 1-pint	150
Sipper tubes — stainless steel, ball bearing ends	150
Rubber stoppers — size 7, 1-hole	150
Drain — floor, garbage disposal unit	1
Cleaning station, hot and cold water	1
Gerbil feed bin	1
Gerbil room environmental recorder	1
Work table	1
Wall storage cabinet	1
Scale — exact weight scale, instant reading	1
Metabolism cage	15
Sink — stainless steel, double compartment, drainboard	1
Racks (cage) — stainless steel, 5-shelves, castered	2
Caging — plastic, polycarbonate 10-1/2" x 19" x 6-1/4"	120
Cage lids — stainless steel 10-1/2" x 19", feeder type	120
Water bottles — glass, 1-pint	120
Sipper tubes — stainless steel, ball bearing ends	120
Rubber stoppers — size 7, 1-hole	120
Exercise cages — stainless steel with counter	2
Restraining device — stainless steel	6
Drain — floor, with garbage disposal unit	1
Cleaning station, hot and cold water	1
Quail feed bin	1
Quail room environmental recorder	1
Work table storage cabinet	1
Wall storage cabinet	1
Scale — exact weight, instant reading	1
Bird metabolism cages	15
Sink — stainless steel, double compartment, drainboard	1
Caging — stainless steel rack with 3 bird cages, castered	2
Drain — floor, with garbage disposal unit	1
Cleaning station, hot and cold water	1

Item	Quantity
Refrigerator — compact (to hold Quail eggs)	1
Exhaust system (cage wash area) — to remove excess heat, steam and condensation from washroom area	1 or as required
Sinks — stainless steel, partitioned type with storage area in base	2
Wall storage cabinet	2
Water fountains — foot activated type	2
Counter top cabinets — top resistant to chemicals and detergent	2
Laboratory stools	2
Cleaning station — steam	1
Drain — floor	1
Cage washing machine — tunnel type with conveyor for cage locomotion	1
Cage rack and large animal cage washer — double door type	1
Autoclave — 36" x 48" x 60" size, double door, high vacuum cycle attachment, for ethylene oxide gas sterilization also	1
Bottle filler — water, stainless steel, automatic, 20-24 bottle capacity	1
Bottle racks — stainless steel, capacity of 20-24 16 oz. bottles	25
Cage storage shelving	As room allows
Receptacle for animal cage bedding — stainless steel, casters and removable lid, capacity 200 lbs. bedding, partitioned	2
Cabinet (food, bedding and storage area) — 3 drawers, open shelving above, metal, drawers to be rodent proof	2
Shelving — floor to ceiling, open, adjustable	As room allows
Bin and shelving units — closed, rodent proof, 2' wide x 3' long x 4' deep, metal	4
Work tables — 30" x 60"	2
Receptacles — waste, stainless steel, 20 gallon capacity	4
Refrigerator, upright, explosion proof, 14 cu. ft. with 3 cu. ft. freezer compartment	1
Sink — stainless steel, double compartment, garbage disposal	1
Can opener — automatic	1
Hot plate — heavy duty, 2 or 3 burners	1
Food mixer blender — commercial type	1
Chopping block — approved non-wood type with knives	1
Food scales — measured in grams or ounces	1

Item	Quantity
Animal incinerator (destruction room) — combustion tube crematory destructor, 10'7" x 4' x 4' or larger	1
Oil tank — 1000 gallon capacity, underground	1
Fan — size to provide adequate oxygen for combustion and cooling	1
Cleaning station — hot and cold water and steam	1
Waste cans — 33 gallon capacity	6
Drain	1
Screened enclosure — fireproof, lockable	As required
Exhaust fan (refrigerated waste area) —size motor and fan as required, manual switched	As required
Compressor	As required
Cleaning station — equipped with steam, cold and hot water	1
Waste cans — 33 gallon, stainless steel	8
Drain — floor	1
Garbage cans, trash room, 33 gallon, stainless steel	10
Drain — floor, garbage disposal unit	1
Lockers, mens' and womens' — full length, individual	290
Showers, mens' and womens', pass through design	8
Total estimated cost	$363,480

Surgery — Pharmacy — Radiology — Clinical Laboratory Equipment

Item	Quantity
X-ray machine — 200 MA, 125 KVP, high speed timer, heavy duty contactor	1
X-ray table — table with Potter-Bucky movable grid	1
X-ray tube-stand — twin track floor to ceiling	1
X-ray machine — 15 MA, 85 KVP portable	1
Wall hangers — for X-ray aprons and gloves, peg type	6
Docimeters	36
Illuminator, wall mounted, 4 sections, 6 feet long	1
Counter space — top impervious to chemicals	As room allows
Cabinets	2
Clock, wall	1
Stools, student	18
Controller — X-ray machine	1
Operator — X-ray table	1
Viewing window, lead glass, size as required	12
Tanks — film processing, stainless steel	2
Transfer box — built-in, light proof	1
Paddles — stainless steel, mixing	2
Dryer — X-ray film, with fan	1
Film storage bin — light proof	1
Counter space — top impervious to chemicals	As room allows
Film trimmer	1
Cassette storage cabinet — 4' x 20" x 20" with vertical dividers	1
File cabinet — film storage	1
Film holder rack — pegboard, wall mounted	2
Film cassettes — various sized	As required
Illuminator — X-ray, 24" x 24", with "safe light"	1
Pilot light, at entrance to darkroom	As required
Safe light, inside darkroom	As required
Surgical tables — hydraulic, stainless steel	3
Surgical table — hydraulic, V-top, stainless steel	1
Surgical lamps — double, track mounted	4
Electrocautery instrument	1
Surgical kick buckets — stainless steel, wheel mounted stand	6
Wall cabinets, storage	2
Instrument stands — adjustable, stainless steel	4
Inhalation anesthesia machine	3
Radiological film viewer for surgery room	1
Stools — adjustable back, adjustable height, metal	12
Emergency suction apparatus	1
Surgical oxygen source	1
Heart defibrillator	1
Dressing carts — stainless steel, mobile	2
Scrub sinks — knee operated	3
Soap dispenser — foot operated	3
Scrub brush dispenser — autoclavable	3
Arm immersion tanks	2
Towel dispenser	3
Wall cabinet with shelves	1
Rack — clothes	1
Surgical table (Preparation and	

Item	Quantity
Treatment Room) — hydraulic stainless steel	1
Clippers — animal, with various sized blades	4
Bathtub — animal, with grate and cover, stainless steel	1
Whirlpool apparatus	1
Scales — shelf type animal scales, measured in pounds	1
Scales — floor type, human balance scales	1
Storage cabinets	As room allows
Animal dryer	1
Dressing cart — stainless steel, mobile (for Preparation and Treatment Room)	1
Refrigerator — 14 cu. ft. with 3 cu. ft. freezer unit, explosion proof	1
Sink — double drain	1
Ophthalmoscope-otoscope, wall mounted	1
Dental cleaning unit	1
Narcotics locker cabinet — double door, double locking system, warning light	1
Surgical lamp (for Preparation and Treatment Room)	1
Record chart cart — clinical and patient, castered, stainless steel, removable clipboards	1
Washing machine — automatic, heavy duty	1
Clothes dryer — automatic, heavy duty	1
Electric iron — steam type	1
Laundry sink — double drain	1
Autoclave — sterilizer with vacuum exhaust, ethylene oxide adapter, floor model	1
Counter-cabinet — base storage	As room allows
Sterilizer — foot operated, boiling water	1
Distilled water apparatus, pyrogen free capability	1
Incubator-oven — dry heat	1
Storage cabinets	As room allows
Work table	1
Dog caging (Recovery Room) — Shor-Line 5-unit assembly, stainless steel	1
Oxygen control and humidification unit	1
Counter space storage cabinets	As room allows
Examination table — wall mounted, stainless steel	1
Refrigerator — 6 cu. ft., explosion proof (Recovery Room)	1
Refrigerator (Pharmacy Area) — 18 cu. ft., with 6 cu. ft. freezer unit, explosion proof	1
Storage area and work space cabinets (Pharmacy Room) chemical resistant counters	As room allows
Waring blender	1
Narcotics cabinet — double lock metal cabinet, warning light	1
Sink — double drain	1
Hot plates — with stirring mechanism	2
Typewriter — electric, large carriage	1
Filing cabinet — 5 drawer, legal size with locks	1
Chemical scales — electric balance, analytical	1
Window — pass-through	1
Card file	1
Desk — with typewriter leg	1
Chair — swivel, desk	1
Counter stools — adjustable with backs	2
Safe — wall or bench, burglarproof, fireproof	1
Calculator — electric	1
Total estimated cost	$100,280

Meat Inspection Laboratory Equipment

Item	Quantity
Band saw, all purpose, floor model	1
Beef paunch table	1
Skinning cradle	1
Gambreling table	1
Electric hoist, ceiling mounted	1
Table, cutting	3
Meat chopping block, approved type	1
Utility and wrapping table	1
Load lugger cart with lugs	1
Smokehouse, portable	1
Retained beef cage	1
Single lug dolly	1
Double lug dolly	1
Trash cans	2
Waste receptacles	2
Meat trees	10
Hog gambrel	15
Sandwich board	6
Scale, carcass	1
Lug cover	6
Utility lug	4
Carborundum stone	4

Item	Quantity
Tapeshooter-50	1
Hog flank spreader	50
Bell hog scraper	6
Pork loin knife	2
Multi-oilstone set	2
Scabbard, all aluminum	12
Sticking knife	4
Butcher knife	4
Steak knife	6
Boning knives	36
Stainless steel armored skewer thermometers	2
Baby dial executive thermometers	2
Hot water thermometers	2
Wall thermometers	2
Sanitary aluminum stomper	1
Pork and lamb cleavers	3
All-use pattern cleaver	3
Bone dust remover	6
Block scrapers	6
Spider dollies	2
Galvanized steel gambrel	4
Smoke trays	2
Wire holders	6
Metal mesh gloves	40
Safety hats	18
Flexi-gard meat aprons	18
Arm guard metal	2
Metal mesh aprons	3
Aerofog sprayer	1
Lever grease gun	1
Heavy duty wet-dry pickup and accessories	1
Fiberok heavy duty utility can	2
Garbage can with cover	2
Step ladders, metal	2
Shelving, steel, closed type, non-ledge	8 sections
Lockers, steel	12
Convertible utility truck	1
Calculator, electric	1
Refrigerator display case	1
Head inspection stand, metal	1
Beef paunch truck	1
Heavy duty hot water hose with accessories	100 ft.
Stainless steel meat container with cover	1
Heart and chain shackle	1
Work platform	1
Meat utility pan	1
Freezer tape dispenser	1
Zip-tyer, with accessories	1
Bone dust remover	12
Humidity indicator	1
Sharpening steels	12
Oilstones	3
Butcher saws	4
Hog toenail puller	1
Utility hook strips	6
Coat rack for coats and hats	1
Ladders, aluminum	2
Beef tree	2
Pickling tank	1
Meat work tables, stationary	2
Meat work tables with casters	2
Chairs, folding steel	6
Cord reel for electric hoist	1
Hand truck, medium duty	1
Meat shear	1
Garbage cans with covers	6
Casters with pevolon wheels	4
Swivel casters, stainless steel bushings	2
Meat hook rail rack	1
Hoist with chain container	1
Deep fat fryer with basket	1
Shelf assembly	1 unit
Lockers, full length	6
Locker, tiered	1
Mobile shelf unit	1
Pans, meat processing	6
Remote reading thermometer for walk-in cooler	1
Food blender	1
Total estimated cost	$24,900

SUMMARY OF COSTS

The following estimates are for the cost of completely supplying and equipping a department for teaching veterinary technicians at the time of developing this guide (1972). The estimates are based upon the purchase cost of new and modern equipment and supplies of good quality, but of the most expensive type. Leasing, renting, or other possible arrangements may significantly reduce these figures. The following assumptions are made:

(1) The program can be started for a lower initial expenditure than the estimates shown, but complete plans for, and assurance of obtaining, adequate facilities soon after the program begins will be a part of the institution's policy when initiating the program.

(2) Adequate land for facilities needed for program implementation is assumed to be available, either owned or secured by a long

term lease.

(3) Classrooms, support laboratories, a library, a college farm complex, and other instructional facilities are assumed to be available for all except the technical specialty classes and laboratory work associated with the program.

(4) No provision is made in this estimate for office furniture, conventional classroom blackboards, conventional staff or instructor's office equipment, janitorial equipment or rest room — locker room equipment, except student lockers and showers themselves.

(5) The estimates assume the availability of a building of suitable construction for the laboratories equipped with normal services, such as electricity, heat, and water to and from the building, but otherwise unfurnished. The cost estimates include piping, wiring, plumbing, and other distribution of services within each facility described.

(6) Cost summaries are provided for each functional laboratory separately, so that cost comparisons and totals may be arrived at more easily.

(7) Laboratory facilities and equipment, in each case, are provided to accommodate classes of 20 to 30 students per laboratory in question. Some classes, of course, because of the nature of the subject matter, may have to be much smaller than 20.

Laboratory Equipment for the Program

	Estimated Cost
Basic Sciences Laboratory	$246,870
Conventional Research Laboratory	103,660
Instructional Media Equipment	9,550
Maximum Barrier Research Laboratory	363,480
Surgery-Pharmacy-Radiology Clinical Laboratory	100,280
Subtotal	$823,840

Additional Laboratory Equipment for the Meat Inspection Option

Meat Inspection Laboratory	24,900
Total estimated cost for the Combined Program	$848,740

The foregoing estimates do not provide for the cost of the two buildings. If the building for the Veterinary Science Technology Program must be constructed, costs should be calculated at approximately $65 per square foot of laboratory space, furnished ready to receive movable equipment. All cost factors and data must be adjusted for geographical areas and the actual facility construction date. The construction costs for this facility appear unusually high but reflect compliance with special legal requirements for complete environmental controls systems and provision for the unique Maximum Barrier Research Laboratory. The construction costs for the Meat Inspection Laboratory can be calculated at approximately $49 per square foot of laboratory space furnished ready to receive movable equipment.

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Appendix

SELECTED LIST OF PROFESSIONAL AND TECHNICAL SOCIETIES AND ORGANIZATIONS WHICH RELATE TO THE CURRICULUM OF VETERINARY SCIENCE TECHNOLOGY

Interested educators may find this selected list of professional and technical societies and associations to be a useful source of instructional information, reference data, audio-visual aids or even for acquiring outstanding guest speakers from industry.

The selected list which follows is not a complete listing of all known organizations which relate to this career field. It should also be noted that inclusion of an organization in this list does not imply special approval, nor does omission imply disapproval.

A request concerning general information, services rendered, or for specific information made to any of the below listed organizations is usually more promptly answered by addressing the inquiry to the "Executive Secretary" of the respective organization.

AMERICAN ANIMAL HOSPITAL ASSOCIATION (AAHA), 3920 East Jackson Boulevard, Elkhart, Indiana 46514

An organization of veterinarians engaged in small animal practice who own small animal hospitals. For the advancement of hospitalization of pet animals. Convention/meeting: annual.

Publication: *Animal Hospital*, quarterly.

AMERICAN ASSOCIATION FOR ACCREDITATION OF LABORATORY ANIMAL CARE (AAALAC), 4 East Clinton St., Suite 605, P.O. Box 13, Joliet, Illinois 60434

National group of education, health, and research organizations professionally concerned with the care, study, and use of laboratory animals in scientific research. Plans a program for accreditation of laboratory animal care facilities. Will make site visits to institutions seeking accreditation, review all applications, and evaluate the site visitors' reports.

AMERICAN ASSOCIATION FOR CONTAMINATION CONTROL (AACC), 6 Beacon St., Boston, Mass. 02108

An organization concerned with contamination control involving, in part, representatives of pharmaceutical, medical and biological sciences, managers of hospitals, educators and students, with interest in that field. Convention/meeting: annual.

Publication: *Journal of the A.A.C.C., monthly.*

AMERICAN ASSOCIATION FOR LABORATORY ANIMAL SCIENCE (AALAS), P.O. Box 10, Joliet, Illinois 60434

An organization composed of biomedical researchers, physicians, veterinarians, animal technicians, commercial animal breeders, feed and equipment manufacturers and others professionally engaged in the breeding, care and use of laboratory animals. Convention/meeting: annual.

Local branches of this national organization also provide opportunities for participation in educational and professional programs. Interested individuals should write to the Executive Secretary of AALAS, for names and address of local branches of AALAS in their area.

Publications: (1) *Laboratory Animal Care*, bi-monthly; (2) *ACP Bulletin*, quarterly; (3) *Membership Directory*, irregular.

AMERICAN ASSOCIATION FOR THE ADVANCEMENT OF SCIENCE (AAAS), 1515 Massachusetts Avenue, N.W., Washington, D.C. 20005

The largest general scientific organization representing all fields of science. Membership includes individuals and scientific societies, professional organizations and state and city academies. Sections of this organization relevant to animal science include: zoological sciences, medical sciences, pharmaceutical sciences, agriculture, industrial science, education and statistics. Convention/meeting: annual.

Publications: (1) *Science*, weekly; (2) *Symposium Volumes;* (3) *Science Education News*, quarterly; (4) *AAAS Bulletin*, quarterly; (5) *Understanding*, quarterly; (6) *Science Books*, quarterly.

AMERICAN ASSOCIATION OF BOVINE PRACTITIONERS (AABP), P.O. Box 2319, West Lafayette, Indiana 47906

An organization of veterinary practitioners engaged in the practice of bovine medicine and surgery. The organization seeks to promote research on bovine diseases and disseminate among its members the latest scientific information relative to clinical practice with this species. Convention/meeting: annual (held with A.V.M.A.).

Publication: *The Bovine Practitioner*, bi-monthly.

AMERICAN ASSOCIATION OF EQUINE PRACTITIONERS (AAEP), Route 3, 14 Hillcrest Circle, Golden, Colorado 80401

For veterinarians engaged in the practice of equine medicine and surgery, to disseminate latest scientific information relative to clinical practice with this species; to promote research on horse diseases. Convention/meeting: annual.

AMERICAN ASSOCIATION OF VETERINARY LABORATORY DIAGNOSTICIANS (AAVLD), P.O. Box 70, Ames, Iowa 50010

A professional organization composed of veterinarians who are engaged in veterinary diagnostic laboratory service. To disseminate and share the latest techniques and methods developed for enhancing the scope and quality of laboratory diagnostic services to practitioners.

AMERICAN ASSOCIATION OF ZOO VETERINARIANS (AAZV), 4542 Seminary Road, Alexandria, Virginia 22304

A professional organization composed of veterinarians who sponsor educational, scientific, and professional meetings to advance the knowledge of and veterinary service for the exotic animal.

AMERICAN COLLEGE FOR LABORATORY ANIMAL MEDICINE (ACLAM), Institute for Laboratory Animal Resources, 2101 Constitution Avenue, Washington, D.C. 20418

An organization of veterinarians specializing in laboratory animal medicine. Establishes standards of training and experiences for qualification of specialists in the field, administers examinations, and certifies eligible specialists. En-

courages education, training and research in laboratory animal medicine.

AMERICAN COLLEGE OF VETERINARY PATHOLOGISTS (ACVP), Veterinary Pathology Building, 1925 Coffey Road, Columbus, Ohio 43200

A professional society of specialists in veterinary pathology (origin, nature and course of disease in animals). Recognized as the certifying agency for the specialty of veterinary pathology in the United States and Canada.

AMERICAN INSTITUTE OF BIOLOGICAL SCIENCES (AIBS), 3900 Wisconsin Avenue, N.W., Washington, D.C. 20016

Federation of professional biological associations and individuals with an interest in the life sciences. To promote unity and effectiveness of effort among persons engaged in biological research, teaching or application of biological data; to further the relationships of biological sciences to other sciences, the arts and industries. Convention/meeting: annual.

Publications: (1) *BioScience*, monthly; (2) *Review of Biology*, quarterly; (3) symposia proceedings, irregular; (4) AEC-AEBS monographs and (5) select single titles, irregular.

AMERICAN MEAT INSTITUTE FOUNDATION (AMIF), 59 East Van Buren Street, Chicago, Illinois 60605

A scientific research and educational institution, affiliated with the University of Chicago. Engages exclusively in research related to production of livestock and processing and utilization of products derived from livestock through grants-in-aid programs to colleges and universities. Convention/meeting: semiannual.

Publication: *AMIF Bulletins*, irregular.

AMERICAN PUBLIC HEALTH ASSOCIATION (APHA), 1790 Broadway, New York, New York 10019

A professional organization of physicians, nurses, educators, engineers, dentists, industrial hygienists, other community health specialists and interested lay persons seeking to protect and promote public and personal health. Its services include promulgation of standards, establishment of uniform practices and procedures, development and evaluation and appraisal processes, tabulation of important facts on the etiology of communicable diseases, creation of testing methods for selection of professional public health workers, establishment of desirable minimum educational qualifications, sponsoring accreditation of schools of public health, research in many areas of public health, exploration of various types of medical care programs and their relationship to public health. Convention/meeting: annual.

Publication: *American Journal of Public Health*, monthly.

AMERICAN SOCIETY FOR MICROBIOLOGY (ASM), 115 Huron View Boulevard, Ann Arbor, Michigan 48100

A scientific society of microbiologists. Bacterial physiology; medical immunology; virology; industrial. Convention/meeting: annual.

Publications: (1) *Journal of Virology*, bi-monthly; (2) *Journal of Bacteriology*, monthly; (3) *Applied Microbiology*, bi-monthly; (4) *Bacteriological Reviews*, quarterly; (5) *Bacteriological Proceedings*, annual; (6) *Antimicrobial Agents and Chemotherapy*, annual.

AMERICAN SOCIETY FOR PHARMACOLOGY AND EXPERIMENTAL THERAPEUTICS (ASPET), 9650 Rockville Pike, Bethesda, Maryland 20014

A scientific society of investigators in pharmacology and toxicology interested in research and promotion of pharmacological knowledge and its use among scientists. Convention/meeting: semi-annual.

Publications: (1) *Journal of Pharmacology and Experimental Therapeutics*, monthly; (2) *Molecular Pharmacology*, bi-monthly; (3) *Pharmacological Reviews*, quarterly; (4) *Pharmacologist*, semi-annual.

AMERICAN SOCIETY OF ANIMAL SCIENCE (ASAS), % Q Corporation, 39 Sheridan Avenue, Albany, New York 12210

Professional society of persons engaged in investigation, instruction or extension in animal science, or in the production of livestock products. Convention/meeting: annual.

Publication: *Journal of Animal Science*, quarterly.

AMERICAN SOCIETY OF LABORATORY ANIMAL PRACTITIONERS (ASLAP), % A.V.M.A., 600 South Michigan Avenue, Chicago, Illinois 60605

An organization of veterinarians engaged, full or part-time, in the practice of laboratory animal medicine. Convention/meeting: annual (with A.V.M.A. and A.A.L.A.S.).

Publication: *Synapse*, quarterly.

AMERICAN SOCIETY OF MEDICAL TECHNOLOGISTS (ASMT), Hermann Professional Building, Suite 25, Houston, Texas 77025

Primarily composed of medical technologists who have been certified by the Registry of Medical Technologists of the American Society of Clinical Pathologists. Also includes specialists who hold at least a master's degree in one of the major fields of medical technology, specialists with limited certificates, and students enrolled in AMA and military medical technology schools. Seeks to promote and maintain high standards in clinical laboratory methods and research, and to advance standards of education and training. Convention/meeting: annual.

Publications: (1) *American Journal of Medical Technology*, bi-monthly; (2) *ASMT News*, monthly; (3) *Award-O-Gram*, annual; (4) *ASMT Directory*, irregular; (5) *Audio-visual Library Bulletin*, biennial.

AMERICAN SOCIETY OF PARASITOLOGISTS (ASP), Microbiology Department, South Western Medical School, University of Texas, Dallas, Texas 75235

A professional society of persons interested in improving the teaching and promoting the study of parasites and related sciences. Convention/meeting: annual.

Publication: *Journal of Parasitology*, bi-monthly.

AMERICAN SOCIETY OF VETERINARY CLINICAL PATHOLOGISTS (ASVCP), 3222 Marnat Road, Baltimore, Maryland 21208

A professional and scientific organization for the purpose of education and improvement of veterinary clinical pathology services to research scientists and practitioners.

AMERICAN VETERINARY MEDICAL ASSOCIATION (AVMA), 600 South Michigan Avenue, Chicago, Illinois 60605

A professional society of veterinarians. Councils: judicial, education, research, biological and therapeutic agents, public health and regulatory veterinary medicine, and veterinary service. Sections: research, small animals, poultry, and public health. Convention/meeting: annual.

Publications: (1) *Journal of AVMA*, semi-monthly; (2) *American Journal of Veterinary Research*, bi-monthly.

AMERICAN VETERINARY SOCIETY FOR THE STUDY OF BREEDING SOUNDNESS (AVSSBS), Association Building, 9th and Minnesota, Hastings, Nebraska 68901

An associated group of veterinarians active in gathering and disseminating the latest research information regarding breeding soundness in all species. Application of new practice methods and techniques for improving veterinary services to animal breeders is encouraged. Convention/meeting: annual (occasionally cosponsors scientific programs with the A.V.M.A. convention).

Publication: Meeting proceedings, irregular.

ANIMAL HEALTH INSTITUTE (AHI), 940 Executive Building, 1030 15th Street, N.W., Washington, D.C. 20005

An organization of manufacturers of antibiotics, drugs and chemicals used in animal health and nutrition products. Special committees: Feed Additives; Law; Pharmaceutical Products; Research; Scientific Advisory; Veterinary Biologicals. Convention/meeting: annual.

Publication: *AHI Reporter*, monthly.

ANIMAL MEDICAL CENTER (AMC), 62nd Street and East River Drive, New York, New York 10021

This institution conducts research into the nature of animal disease for the benefit of both animal and human health; provides the best possible treatment for sick animals; educates veterinarians and technicians in specialty of small animal medicine and in comparative medical research; and dissemination of knowledge. Research includes infectious disease, cardiovascular disease, cancer, metabolic and endocrine disease.

ANIMAL NUTRITION RESEARCH COUNCIL (ANRC), Dawe's Laboratories, Inc., 4800 South Richmond Street, Chicago, Illinois 60632

The council sponsors research on animal feeds. It also encourages research in animal nutrition and promotes collaborative studies of assay methods for nutritional factors. Convention/meeting: annual.

Publication: *ANRC Newsletter*, semi-annual.

ANIMAL TECHNICIANS ASSOCIATION (ATA), Medical Research Council, Mill Hill, London, England

An organization for professional improvement and education of the laboratory animal technician.

Publication: *Journal of the Animal Technicians Association*, semi-monthly.

ANIMAL WELFARE INSTITUTE (AWI), 22 East 17th Street, New York, New York 10003

The Institute promotes humane treatment of animals, particularly animals used in research and medicine. Convention/meeting: annual.

Publications: (1) *Information Report*, bi-monthly; (2) Manuals are also published for special topics, these include: *Comfortable Quarters for Laboratory Animals, Basic Care of Experimental Animals, First Aid and Care of Small Animals* (for primary teachers) and *Humane Biology Projects* (for secondary teachers).

ASSOCIATION FOR GNOTOBIOTICS (AFG), 1630 Latham Drive, Madison, Wisconsin 53700

Composed of biological, medical and veterinary scientists and technicians interested and involved in research and/or development using germfree animals and equipment.

Publication: *AFG Newsletter*, periodic.

ASSOCIATION OF AMERICAN BOARDS OF EXAMINERS IN VETERINARY MEDICINE (AABEVM), 1680 Teaneck Road, Teaneck, New Jersey 07666.

An organization to improve methods of examining candidates for licensure, to elevate standards of proficiency; to exchange information on enforcement of practice arts; and to prepare a uniform minimum of standards for practice and licensure. Convention/meeting: annual.

ASSOCIATION OF AMERICAN VETERINARY MEDICAL COLLEGES (AAVMC), New York State Veterinary College, Ithaca, New York 14850

An organization composed of colleges of veterinary medicine in the United States and Canada to promote common interests in veterinary medical research and teaching. Conference: annual (with A.V.M.A.).

CONFERENCE OF PUBLIC HEALTH VETERINARIANS (CPHV), 2 East 63rd Street, New York, New York 10021

A professional society of veterinarians interested in public health, education and scientific progress in veterinary public health; to encourage educational training and research and the exchange of scientific information. Convention/meeting: annual.

CONFERENCE OF RESEARCH WORKERS IN ANIMAL DISEASES (CRWAD), College of Veterinary Medicine, University of Minnesota, St. Paul, Minnesota 55100

An organization for research workers in animal diseases employed by governmental or endowed institutions. Convention/meeting: annual.

COUNCIL OF BIOLOGY EDITORS (CBE), Department of Biology, University of Notre Dame, Notre Dame Indiana 46556

Composed of active and former editors of primary and secondary journals in the biological sciences, through study groups, panels, and committees, investigates all aspects of biological communication with emphasis on publication, especially publication in primary journals and retrieval in secondary media. Convention/meeting: annual.

Publications: (1) *Newsletter*, irregular; (2) *Style Manual for Biological Journals*, in conjunction with American Institute of Biological Sciences.

FEDERATION OF AMERICAN SOCIETY FOR EXPERIMENTAL BIOLOGY (FASEB), 9650 Rockville Pike, Bethesda, Maryland 20014

This is a federation of six scientific societies; American Physiological Society; American Society of Biological Chemists; American Society for Pharmacology and Experimental Therapeutics; American Institute of Nutrition; American Society for Experimental Pathology; American Association of Immunologists. Convention/meeting: annual.

Publications: (1) *Federation proceedings*, bi-monthly; (2) *Placement Service Bulletin*, bi-monthly.

FUTURE FARMERS OF AMERICA (FFA), Office of Education, U.S. Department of Health, Education, and Welfare, Washington, D.C. 20202

An organization for farm boys studying vocational agriculture in rural public secondary schools. Organized under National Vocational Education Act to foster character development, agricultural leadership and citizenship, and to supplement training opportunities for boys planning toward farming. Convention/meeting: annual.

Publication: *National Future Farmer Magazine*, bi-monthly.

INDUSTRIAL VETERINARIANS' ASSOCIATION (IVA). No central headquarters address, % address of the Presiding Officer at the moment, rotates with change of officers.

Composed of veterinarians who are also members of the American Veterinary Medical Association and are employed in a professional capacity in industrial activities (for example, with drug and chemical firms, in livestock and poultry enterprises, or in independent research). Hold annual regional workshop sessions. Convention/meeting: annual (held with A.V.M.A. Convention).

Publications: (1) *IVA Newsletter*, 3/year: (2) *Directory of Veterinarians in Industry.*

INSTITUTE OF LABORATORY ANIMAL RESOURCES (ILAR), The National Science Foundation, 2101 Constitution Avenue, N.W., Washington, D.C. 20418

The Institute provides educational, informational communications and many other essential services to laboratories and individuals on a national and international basis. It is also involved in research efforts utilizing laboratory animals.

Publications: (1) *ILAR News*, quarterly; (2) *Users of Laboratory Animals*, annual; (3) *Animals for Research*, annual.

INTERNATIONAL ASSOCIATION OF MILK, FOOD AND ENVIRONMENTAL SANITARIANS (IAMFES), P.O. Box 437, Blue Ridge Road, Shelbyville, Indiana 46176

An organization composed of food and drug officials, milk and food industry fieldmen and technicians, laboratory workers, sanitary engineers, re-research, teaching, agriculture and military personnel. It develops uniform and proper methods of food and milk supervision and inspection. Convention/meeting: annual.

Publications: (1) *Journal of Milk and Food Technology*, monthly; (2) Also publishes sanitary standards, and procedures for investigation of food-borne disease outbreaks.

LABORATORY ANIMAL BREEDERS ASSOCIATION (LABA), Charles River Breeding Laboratories, 251 Ballardville Street, Wilmington, Massachusetts 01887

The organization breeds animals especially for research. It promotes and maintains ethical practices in production and marketing of laboratory animals; aids in support of activities of regional diagnostic centers for the study and diagnosis of diseases of laboratory animals; functions as the agency for standardizing and improving methods and breeding techniques of laboratory animals and accredits colonies. Convention/meeting: annual.

Publication: *Newsletter*, quarterly.

NATIONAL ASSOCIATION OF FEDERAL VETERINARIANS (NAFV), Suite 828, 1522 K Street, N.W., Washington, D.C. 20005

A nonprofit corporation formed for the purpose of promoting the veterinary profession, to improve the professional efficiency and material interests of its members, to cooperate with the American Veterinary Medical Association and other recognized veterinary and livestock sanitary associations. Convention/meeting: annual (with A.V.M.A. and U.S.A.H.A.).

Publication: *The Federal Veterinarian*, monthly.

NATIONAL 4-H SERVICE COMMITTEE, 59 East Van Buren Street, Chicago, Illinois 60605

An organization of business executives, educators and private citizens devoted to the advancement of 4-H Club work. Grants awards, at county, state, and national levels to current or former 4-H members for accomplishments in specific programs. Convention/meeting: annual.

Publications: (1) *National 4-H News*, monthly; (2) *National Committee Comments*, 3/year.

NATIONAL SOCIETY FOR MEDICAL RESEARCH (NSMR), 1330 Massachusetts Avenue, N.W., Washington, D.C. 20005

A federation of associations, institutions, and companies concerned with research in biology and medicine. It works to improve public understanding of the principles, methods, and needs of the biological and medical sciences. Convention/meeting: annual.

Publications: (1) *Newsletter*, monthly; (2) Also publishes pamphlets and special reports.

PHARMACEUTICAL MANUFACTURERS ASSOCIATION (PMA), 1155 15th Street, N.W., Washington, D.C. 20005

An organization composed of manufacturers of ethical pharmaceutical or biological products which are distributed under their own labels. Members account for upwards of 95 percent of U.S. sales of prescription drugs. The organization encourages high standards for members' products, research toward development of new and better medical products, better facilities and methods for pharmacological and clinical evaluation of them, and safer methods for their manufacture, packaging, and transportation; enactment of "uniform and reasonable drug legislation for the protection of public health". Disseminates information on governmental regulations and policies, but does not maintain or supply information on specific products, prices, distribution, promotion, or sales policies of its individual members. Maintains library of 400 volumes on pharmacology and medicine. Sections: Biological, Medical, Quality Control, Production and Engineering, Research and Development, Financial, International, Law, Public Relations. Convention/meeting: annual.

Publications: (1) *Newsletter*, weekly; (2) *Trademark*, weekly: (3) *PMA Bulletin*, monthly; (4) *World Review of Drug News*, biweekly; (5) *Product Liability*, irregular; (6) *State Capital Reports*, irregular; (7) *Administrative Officers (directory)*, annual; (8) *Membership List*; (9) *Trademarks Listed with PMA*, triennial.

SOCIETY FOR EXPERIMENTAL BIOLOGY AND MEDICINE (SEBM), 630 West 168th Street, New York, New York 10032

A society of workers actively engaged in research in experimental biology or experimental medicine. To cultivate the experimental method of investigation in the sciences of biology and medicine.

Publication: *Proceedings*, 11 issues annually.

SOCIETY FOR INDUSTRIAL MICROBIOLOGY (SIM), 3900 Wisconsin Avenue, N.W., Washington, D.C. 20016

A society composed of mycologists, bacteriologists, biologists, chemists, engineers, zoologists and others interested in

biological processes as applied to industry. Convention/meeting: annual.

Publications: (1) *Developments in Industrial Microbiology*, annual; (2) *SIM Newsletter*, quarterly.

UNITED STATES ANIMAL HEALTH ASSOCIATION (USAHA), 1444 East Main Street, Richmond, Virginia 23219

An organization composed of veterinarians, livestock producers, transportation and livestock companies concerned with the improvement of the health of livestock and poultry through disease control and eradication. Sponsored committees: Anaplasmosis, Biologics, Brucellosis, Salmonellosis, Animal Virus, Characterization, Exotic Diseases, Hog Cholera Eradication, Laws and Regulations, Livestock Markets, Parasitic Disease, Public Health, Rabies, Tuberculosis, Yards and Transportation. Convention/meeting: annual.

Publication: *Proceedings*, annual.

WOMEN'S VETERINARY MEDICAL ASSOCIATION (WVMA), % American Veterinary Medical Association, 600 South Michigan Avenue, Chicago, Illinois 60605

An organization composed of women veterinarians. Convention/meeting: annual (held with A.V.M.A.).

Publication: *WVMA Bulletin*, quarterly.

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